THE USE OF WORK MEASUREMENT IN THE NAVY

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CHAPTER I

INTRODUCTION

The staggering cost of Defense is a household topic. The need for management improvement within the Department of Defense has been reiterated by numerous commissions and individuals since the report of the First Hoover Commission was published. However, nowhere is the need for economy and management improvement emphasized more strongly than within the Department of Defense itself. If the arsenals of the Military Departments are to be stocked with the new exotic weapons, the Departments are going to have to squeeze the funds out of some existing areas of expenditures. The "level budgeting" policy which has governed the funding of the Defense Establishment leaves no other alternative.

The reconciliation of "economy" with "readiness" can be achieved only through the exercise of effective techniques of management control.

Since 40 per cent of the Navy's budget is expended for personal services--wages and salaries--it would seem that this would be a likely area for the achievement of some savings.

The Navy has a management control device which was designed to insure efficient utilization of personnel and

budgetary control; it is the work measurement program. By measuring man-hour input versus work unit output, management is supposed to be able to locate areas of low productivity and excess manpower and take corrective action.

Work measurement has been in use as a control device for over ten years, but there are very few written evaluations of the program. There are some individuals who give it strong verbal support and others who discount it. Surprisingly, in view of the length of time it has been in use, many Navy personnel have only a nodding acquaintance with it.

The general absence of information concerning the program suggests that a survey of the Bureaus and Offices of the Navy Department be made to determine what their experiences have been in the use of work measurement.

This paper is a report of a survey in breadth, rather than depth, of the use of work measurement by the Bureaus and Offices of the Navy Department. In Chapter II the early motivating forces which made work measurement a Navy-wide program are identified, and the steps taken in its early development are briefly outlined. The elemental mechanics of work measurement and theoretical purposes for which it may be used are discussed in Chapter III. Chapter IV relates the experience of activities outside the Navy in the use of work measurement for management and budgetary purposes. The next chapter gives an account of the reactions of people to the introduction of a work measurement program. Chapters III, IV and V are included for comparative purposes. Chapter VI is a survey report on the

work measurement programs currently in use in the Bureaus and Offices of the Navy Department. The detail of discussion of each program is not related to the importance of the program, but rather to the amount of information which is available concerning it. Chapter VII contains the personal conclusions of the writer drawn from his observations during his survey. Appendix A is a tabulation of the evaluations and opinions of current users of a Bureau of Supplies and Accounts work measurement program.

CHAPTER II

HISTORICAL BACKGROUND

Work measurement first received formal recognition in the Navy as a long-range program on 9 September 1946. A letter from the Acting Secretary of the Navy, W. John Kenney, to Admiral Frederick J. Horne, Chairman of the Budget Revision Board, endorsed findings of the 1946 Committee on Civilian Personnel Requirements which included a recommendation that the Navy install a work measurement program.[1]

There was little centralized direction in the development of a Navy-wide work measurement program in the period following the writing of the above letter; however, some bureaus--Bureau of Supplies and Accounts, Bureau of Yards and Docks and Bureau of Ships among them--developed work measurement programs to suit their own needs. The programs at this stage were simple in concept and operation. They measured group output in a limited number of broad functional work areas. There was no attempt to set time standards or to use stop watches in measurement since such measurement methods were prohibited by provisions in the Navy Appropriation Acts until

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[1] U. S., Department of the Navy, Office of the Secretary of the Navy letter, subject: "Extension of the Duties of the Navy Budget Revision Board," September 9, 1946.

July 1950. The Defense Appropriation Act of 1951 omitted the clause prohibiting time studies of work which had been included in appropriation acts for over thirty years.

Work measurement received impetus in 1950 as a result of Executive Order 10072 issued by the President in support of the findings and recommendations of the Commission on the Organization of the Executive Branch of the Government, the First Hoover Commission. The Executive Order created a government-wide program for management improvement. It defined in broad terms the action required of the Department and Agency heads in the field of management improvement and also assigned specific duties to the Bureau of the Budget.

> 2. The Bureau of the Budget shall (a) review department and agency plans for management improvement in conjunction with requests for funds and at other appropriate times, (b) advise and assist agencies in working out programs to improve their operations, (c) make appropriate arrangements for handling program and operating problems of an inter-agency nature (d) provide for interchange of information on effective management techniques, . . .[2]

The Bureau of the Budget in fulfilling its role as defined in the Executive Order issued instructions for Agency management improvement plans in the form of a Bureau of the Budget circular.

> This Circular further defines the general responsibility placed upon department and agency heads for maintaining continuous appraisal of the economy and efficiency of their operations and for conducting management improvement activities. It requires the development and definition of methods which the departments and agencies will follow in keeping their operations under continuous review and

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[2] U. S., Office of the President, Executive Order 10072, July 29, 1949.

> in conducting a program to identify and solve major management problems. The Circular contains guides for the organization and conduct of systematic reviews, which should be considered in determining the types of review action that will best meet the needs of specific agency programs.[3]

The term "Work Measurement" does not appear in the Bureau of the Budget Circular. However, at one point the following guidance is given:

> In any review technique, standards of comparison should be developed and utilized to the extent possible. Work units should be developed in quantitative terms to set performance standards whenever possible and applicable. Operating reports should measure activities in the same terms that are used to express the standards. Thus where the nature of the work permits, program accomplishments may be shown in relation to a measure of scheduled accomplishment, backlogs and time lags can be compared with standard figures, work output can be measured against standard man hour or man day figures, and costs may be shown in relation to a standard unit.[4]

In April 1950 the Secretary of the Navy informed all bureaus and offices that among the actions that were to be undertaken in implementing Circular A-8 was the Navy's integrated work measurement program.[5] A second letter from the Secretary in April 1950 spelled out the concept of the integrated work measurement program.

> a. The headquarters, Marine Corps, and each Bureau and major Office of the Navy Department shall proceed with the development of work measurement programs most

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[3]U. S., Executive Office of the President, Bureau of the Budget Circular No. A-8, January 31, 1950, p. 3.

[4]Ibid., p. 5.

[5]U. S., Department of the Navy, Office of the Secretary letter, subject: "Navy Department Work Measurement Program," April 4, 1950.

suitable to their needs.
b. In the development of such work measurement programs, however, provision must be made to include such portions of the programs of others having technical responsibility for a function as the technical bureau or office may deem appropriate.
c. Similarly, in the development of such work measurement programs, provision must be made to include such portions of the programs of other bureaus and offices having responsibility for developing Navy-wide criteria in the field of "common services" as such bureaus or offices may deem appropriate.

. . . . . .

One of the long range objectives of an integrated program of work measurement in the Navy Department might well be the development of a uniform format and reporting procedure for recording, collecting and evaluating all formalized work measurement data. . . . it is considered essential that those bureaus and offices having technical responsibility for particular functions on a Navy-wide basis must be provided with data which they consider to be necessary to evaluate the effectiveness of performance on a functional basis and to establish, where appropriate, Navy-wide criteria. In order to accomplish these evaluations in an effective way, it is essential that the technical bureaus and offices be provided with work measurement data that is uniformly prescribed. Normally, the determination of what information is needed and when it is required will be determined by mutual agreement among technical and management bureaus and offices concerned. Nevertheless, the bureau or office which has the technical responsibility for a particular function must make the final decision on the matter.[6]

On 10 July 1950, in implementation of the Secretary's letter, the Work Measurement Coordinating Committee for the Integrated Work Measurement Program was formed. The Committee's objective was to insure bureau and office participation in the development of work measurement policy; therefore, all bureaus and offices were represented in the membership. Its defined

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[6]U. S., Department of the Navy, Office of the Secretary letter, subject: "Navy Department Work Measurement Program," April 27, 1950.

functions included the review of proposals for the integration of all work measurement programs to determine their impact on the individual bureaus and offices as well as on the Navy as a whole; it was to insure that all proposals made use of existing reporting media; and it was also to consider proposals for simplification of the work being measured where more than one bureau or office was involved.[7]

The Coordinating Committee did not develop work measurement programs. The development of programs and the analysis of programs already in effect was the function of program committees appointed by the technical bureaus. The program committees were to analyze and develop work measurement programs for the common services (Supply, Public Works, Fiscal, Personnel) either on their own initiative or at the request of the Coordinating Committee. The Coordinating Committee then reviewed the proposals of the program committees for acceptability to all affected bureaus and offices. If it unanimously approved a proposed program, the work measurement program was submitted to the Assistant Secretary of the Navy for Air (Comptroller) for review and approval prior to adoption by the Navy Department as a whole. A proposal approved by only a majority of the Coordinating Committee, but not unanimously, was to be referred to the Comptroller for resolution.[8]

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[7]U. S., Department of the Navy, Assistant Secretary for Air (Comptroller) letter, subject: "Navy Department Work Measurement Coordinating Committee, Composition and Duties of," July 10, 1950.

[8]Ibid.

It was a ponderous mechanism that had been set up to develop and coordinate the integrated work measurement program. Committee members on both the program committees and the Coordinating Committee performed their duties on a collateral basis. One requirement for a successful work measurement program which is reiterated throughout the literature on work measurement is that it must be kept under constant surveillance to insure that the work measured, the work units and the standards are valid. The collateral duty committee organization was not well suited to this purpose.

Further difficulty was encountered because the work measurement program crossed organizational lines. The resulting confusion sometimes called for clarification through official correspondence.

> All official instructions concerning work measurement programs, applicable to activities under the management control of this Bureau, any changes thereto, and any administrative actions, inquiries, etc. resulting shall emanate from the Bureau of Ships and the Bureau of Ships only.[9]

The program was not responsive to the needs of individual bureaus. If the field activities of one bureau desired that changes be made in an integrated system, recommendations were first submitted to the parent bureau for review. They were then forwarded to the program committee of the technical bureau having cognizance of the common service area for further study and analysis. Next the Coordinating Committee had to pass on the recommendations, and finally the Comptroller approved

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[9]U. S., Department of the Navy, Bureau of Ships letter, subject:"Work Measurement Programs, Administration of," February 5, 1951.

them or resolved any differences.

There was general dissatisfaction with the program. As a result, there was a gradual retreat from emphasis on the integration of the work measurement program.

Eventually, the Under Secretary of the Navy issued an instruction which cancelled the basic directives and the Navy-wide work measurement manuals which had been issued prior to 1955.[10]

A new statement of policy concerning work measurement programs was made; it is still effective.

> 4. Policy. Work measurement programs shall be improved and developed by the bureaus and offices and Headquarters, U. S. Marine Corps to cover the work of their departmental and field activities, to the widest extent practicable. Programs must be tailored to the needs of bureaus and offices and their field activities; however, the maximum practical uniformity should be achieved throughout the department in measuring similar work. Both statistical and engineering techniques incorporating work simplification will be utilized as appropriate in the development of performance standards. Statistical and engineered standards should be integrated to the maximum practical extent in work measurement reporting systems; standards should facilitate comparisons of performance to the extent practicable; and they should be used by management in the evaluation of performance and in the projection of manpower requirements.
>
> The chiefs of the bureaus and offices, and the Commandant of the Marine Corps are to provide for the maximum practicable utilization of work measurement data in management processes and to encourage the further development and use of these programs as management tools.[11]

The Navy Management Office was directed to furnish staff assistance to the bureaus and offices and the Marine

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[10] U. S., Department of the Navy, Office of the Secretary, SECNAV INSTRUCTION 5220.2, October 19, 1955.

[11] Ibid.

Corps and to coordinate the development of work measurement programs in accordance with the stated policy.

Thus the work measurement program had run a complete cycle in a period of six years--from individual bureau control, through integrated control, then back to individual bureau control.

CHAPTER III

ELEMENTARY PRINCIPLES OF WORK MEASUREMENT

The General Characteristics of Work Measurement

> Work measurement is a method of establishing an equitable relationship between the volume of work performed and the manpower utilized in completing that volume. The essential ingredients of work measurement are the measures of output and the measures of employee time.[1]

General speaking, there are two kinds of work measurement; they are differentiated by the method which is used to establish the standards used to evaluate work performance. The first type, that most commonly used in industry, is the kind where performance standards are set by time and motion study, methods-time measurement or other engineering techniques.[2] The second is the statistical kind where the performance standards are developed from a statistical analysis of past

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[1] U. S., Executive Office of the President, Bureau of the Budget Management Bulletin, A Work Measurement System: Development and Use (A Case Study), (Washington: U. S. Government Printing Office, 1950), p. 2.

[2] For a detailed explanation of the techniques used in establishing these standards see Delmar W. Karger and Franklin H. Bayha, Engineered Work Measurement (New York: The Industrial Press, 1959), pp. 29-558.

performance data. The latter type is also commonly known as "functional" or "historical" work measurement.

The essential difference between the two classes of work measurement is that in the industrial engineered type performance standards are established "scientifically" for an individual operation, whereas in the statistical kind the performance standards are established on the basis of past performance of groups of people doing a certain kind of work for a given period of time. The industrial engineering type standard, usually expressed in minutes per work unit, is purported to represent the rate at which an average trained worker can produce if he uses an acceptable or prescribed method of performing an operation. The statistical standard, on the other hand, usually represents the average past production rate which has been attained by a group of workers. Though the standard is usually expressed in work units per man-hour, it is not considered a valid standard against which to compare individual performance; rather, it is applied in evaluating group effort.[3]

Both types of work measurement are currently in use in the Navy. The statistical type has been in use about five years longer than the engineered type and has been used by a wider segment of the Department. Because of the earlier introduction and the wide application of the statistical type, the term "work measurement" usually connotes "statistical work measurement" to members of the naval establishment. The

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[3]U. S., Department of the Navy, Manual for the Integrated Work Measurement Program NAVEXOS P-816, August 1950, p.1-2.

engineered type is usually referred to as "engineered performance standards" or "engineered time standards" rather than "work measurement."

Some strong preferences are held for one type or the other among different individuals and bureaus. However, both types carry the stamp of approval of the Department.

> Work measurement is one of the most powerful tools of modern management. You can use it to evaluate performance, schedule work, isolate cumbersome procedures and unnecessary work, and determine manpower requirements. What many do not realize is that we need two distinct kinds of work measurement to get all these benefits. One kind produces job standards while the other gives us functional norms.
>
> A job standard is the time allowed a worker to do a specific job. . . . Job standards are most useful at the operating level in gauging skill--effort of the working force on assigned jobs, and scheduling such work.
>
> A functional norm specifies the manpower allowed an organization to perform a relatively large area of work, based on broad focal workload indicators. When functional norms are derived from interstation comparisons, they show up where many jobs assigned to the working force may be unnecessary in the first place, especially on overhead functions. Also where basic systems and procedures can be drastically improved. Functional norms can also be used to allocate manpower more economically within field activities.
>
> Obviously, we need both kinds of work measurement to control effectively all aspects of manpower utilization.[4]

The emphasis in this paper will be placed on the statistical work measurement program. This approach is being used because:

(1) Statistical work measurement has had the widest application in the Navy.
(2) There is a large body of professional literature dealing with engineered work measurement, but there is

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[4]"Two Kinds of Work Measurement," Navy Management Review, IV, No. 11 (November 1959), p. 3.

comparatively little documented experience concerning statistical work measurement.
(3) Statistical work measurement seems to be the more controversial subject.

Guidance in the Development and Use of Statistical Work Measurement

In order to present the framework in which the Navy's statistical work measurement program was developed, a number of excerpts from the manual which contained the guidance for the program are quoted in the next few pages. It is considered necessary to include them so that there may be some points of comparison between the original concept and the programs as they stand today.

The Office of the Navy Management Engineer (now the Navy Management Office) was the staff agency which provided centralized guidance and assistance to the bureaus and offices in the development of work measurement programs.

The work measurement manual prepared by this office defined the purposes of statistical work measurement as:

> (1) to provide a factual basis for management control,
> (2) to provide a factual basis for management planning
> (3) to provide a factual basis for budget formulation, justification and control.[5]

Three points were made concerning the use of work measurement in the achievement of the above purposes.

> By comparing the current [work measurement] report with previous reports it is possible to note the trend and determine whether or not a

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[5] Manual for the Integrated Work Measurement Program, op. cit., p. 12.

> unit is operating with increasing or decreasing effectiveness.
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> . . . . . .
>
> The Work Measurement Program, . . . acts as a sort of fire alarm system to bring trouble to the attention of management. The program not only points to trouble, it provides an array of factual data for use by management in "putting out the fire." . . . improvement in an activity is not accomplished by work measurement but by alert conscientious management.
>
> . . . . . .
>
> Before the effectiveness of an activity can be determined, standard rates of performance must be established. It is the application of these standards to actual performance that provides the measure of effectiveness.[6]

These three points are considered to be the "ground rules" for effective application of a work measurement program.

In the development of a work measurement system the first step is the determination of which work should be measured. After the meaningful work has been identified, it must be ascertained that the work measurements can be easily obtained and validated. One inclination that must be avoided is the quest for perfection which may carry work measurement beyond the point of diminishing returns.[7]

A realistic and practicable approach must be taken as to just how far the refinement of the program should go. It is this necessary compromise between perfection and practicability that causes some of the dissatisfaction with statistical work measurement. Every identifiable segment of work cannot be measured if the program is to be kept simple and inexpensive. Therefore a single meaningful unit of work output is often used as a measurement device for a whole function where a

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[6] Ibid., pp. 13-15. [7] Ibid., p. 28.

number of different types of work are performed. The following measurement area and work unit serve as an illustration of the breadth of some measurements. The cited measurement area is included in the Bureau of Weapons Work Measurement program.

> Measurement Area 10.4--Household Goods (Packing and Handling)
>
> Description of Work
>
> The man hours applicable to this measurement area include those expended in picking up and delivering (incoming and outgoing) household goods for authorized personnel (including packing, crating, unpacking and inspecting) by station forces; manufacturing wooden packing containers, and assembling specially designed containers for packing household goods; storing (temporary and non-temporary) household goods; processing applications for transportation of household goods and arranging for shipment of household goods via commercial carriers; arranging for contract packing, handling and storing household goods and maintaining necessary records pertaining to the foregoing.
>
> Work Units
>
> Applications
>
> Definition of Work Units
>
> The work units are the number of incoming and outgoing applications for service on which action was completed during the report period.[8]

Even the most avid proponent of functional work measurement would admit that it is reasonable for the average individual to regard the above work unit with misgivings as a true measure of the work output of a group performing a variety of jobs. However, it is often possible through the use of statistical procedures to find a fairly constant correlation between a single work unit produced by a functional group and the total group effort. Since knowledge of statistical methods is not widespread, it is often difficult to convince personnel

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[8]U. S., Department of the Navy, Bureau of Weapons, BUAER INSTRUCTION 5220.1 Work Measurement Program Manual for Naval Aeronautical Activities, January 1957.

at the working level that functional work measurement produces any meaningful data.

The guidelines for the selection of valid work units set forth the following criteria which should be met.

> (1) The work unit must be countable; that is, expressed in quantitative terms, such as a case, a letter, a file drawer.
> (2) The work unit must express output; that is, volume of work completed, such as a case processed or a letter prepared.
> (3) The work unit must reflect work effort. The work unit which measures the results of work performed does not necessarily measure the effort expended in performing the work. For example, results of processing license applications may be in terms of the number of licenses issued, whereas work effort might be measured in terms of applications processed.
> (4) The work unit must have consistency; that is, the unit must have the same meaning throughout the organization from one period to another. It should be possible to compare work measurement results for one part of an agency at any given time with results for other parts performing the same type work, as well as to compare the results in a single operation on a time trend basis.
> (5) The work unit must be expressed in familiar terminology--familiar, that is, to those who will be responsible for maintaining the workload reports.[9]

The Manual contained an observation concerning engineered standards.

> If a bureau desires to start developing engineered time standards for its industrial operations, it is cautioned that work measurement programs of this character require qualified manpower to maintain them, and are most highly successful for the few large scale repetitive operations that can be highly standardized or for analyzing and simplifying complex methods or procedures. The successful work measurement program maintains a favorable balance as between the savings which result from intelligent utilization of the data on one hand and the cost of establishing standards and collecting and reporting and evaluating

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[9] Manual for the Integrated Work Measurement Program, op. cit., pp. 35-36.

> time data on the other. There is always the danger, of course, that the point of diminishing returns will be exceeded if too precise and detailed a program is established; nevertheless, the need for some kind of work measurement is so great for management improvement as well as budgetary use that at the outset it appears that the risk of exceeding the point of diminishing returns may well be taken with the thought in mind that sooner or later the manpower required to maintain the program will be more than offset by the tremendous potential increased productivity inherent in the proper use of work measurement.[10]

Though the development of engineered standards was not discouraged, neither was it actively promoted. On the other hand, unqualified support was given to the development of standards based on past performance data. This type standard was labeled a "tentative standard" to differentiate it from the engineered standard. The general tenor of the guidance offered is contained in the following excerpts.

> Tentative standards will have much greater validity if they are developed over a period of twelve months and therefore reflect seasonal and other variations which tend to level out over a period of time. However, it is believed that bench marks should be established as soon as practicable and be modified and refined as time progresses.
>
> . . . . . .
>
> In connection with the establishment of tentative standards for control purposes at the Navy Department level, it may be desirable to establish an allowable performance range by statistical method such as 'Standard Deviation' within which operation or function performance rates will be presumed to be satisfactory.
>
> . . . . . .
>
> Apparent inequities are bound to arise which may be subject to controversy. Under these circumstances, it is believed that it would be more realistic and less arbitrary, perhaps, to use the median or average performance rate as a bench mark. As a matter of fact, it is believed that the use of the median figure provides sufficient incentive for activities below average for certain functions and operations to investigate them, make necessary improvements or to achieve a

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[10] Ibid., p. 55.

better utilization of personnel and facilities.[11]

Standards--whether engineered or tentative, whether refined or crude--were considered an essential element for control and comparison in a work measurement program.

The foregoing brief summary of the Manual is considered to reflect the essential characteristics of a functional work measurement program as conceived by the Navy Management Office. In surveying the current programs of work measurement an attempt will be made to assess the degree to which the guidance provided has been followed and whether the potential of statistical work measurement as a management tool has been realized.

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[11] Ibid., p. 59.

CHAPTER IV

THE PROVEN EFFECTIVENESS OF STATISTICAL WORK MEASUREMENT

The Navy entered a field in which little experience had been generated when it adopted statistical work measurement. Measurement based on standards derived from historical data had been discounted with the advent of "Scientific Management." There is little professional literature on the subject. Most authors writing on the field of work measurement dismiss statistical measurement with a few words similar to these of Karger and Bayha.

> Dr. [Frederick W.] Taylor at first established production levels or operation times from past performance records. He later found such production goals established on ordinary historical performance records to be unreliable because they were based on the same poor performance that he had originally noted. He found it impossible to eliminate the effect of poor performance in such records.
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> His next step in the development of work measurement was to use a stop watch to establish the time to perform a given operation.[1]

Taylor, the "Father of Scientific Management," carried on his work during the period 1885-1912. His principles of time study, refined over the years, have been the backbone of most work measurement programs used in industry during the

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[1]Karger and Bayha, op. cit., p. 4.

last half century.

The U. S. Army had pioneered in statistical measurement during World War II and had reported that it was useful in solving a number of problems.

In 1950 the Bureau of the Budget printed a case study to illustrate the steps to be taken and the problems to be solved in developing, "selling," installing,and using a statistical plan of work measurement. The case study related the experience of the Office of the Adjutant General, Department of the Army before and after the development of a work measurement program. The Adjutant General reported that work measurement had proved a useful tool for a number of management areas.

> 1. By providing accurate and reliable data concerning performance and workload, the AGO work measurement system highlighted the areas in need of study by the Organization and Methods Office and the personnel office. In addition, the continued observation of the work measurement data showed the effects of action taken.
>
> 2. Work Measurement provides a means of putting the budget on a performance basis--making it an action document, a device for forecasting and appraising accomplishment. Work measurement makes its contribution through budget formulation and budget execution. . . . It is in providing a means of analyzing manpower utilization, work progress, performance and personnel costs that work measurement serves a purpose in budget execution.
>
> 3. All in all work measurement formed a sound administrative reporting system by which key people at various levels of management could obtain accurate, current, brief and pertinent data from which to make more reliable decisions in administering the business of the Adjutant General's office.
>
> 4. It would be fair to assume that work measurement had been instrumental in obtaining better performance through more effective use of resources. It had provided the supervisor, branch chiefs, division heads and Adjutant General with a tool for--
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> a. Effectively controlling operations.
> b. Locating areas of outstanding and substandard performance.

c. Comparing performance of like operations.
d. Appraising the effect of changes in organization, procedures, personnel recruitment policies, training, physical layout, equipment, etc.

5. Forecasting and justifying future staff requirements in relation to projected volumes of work.
6. Balancing personnel and workload.
7. Programming and scheduling work.
8. Building a performance budget.[2]

The Army also offered some advice on the development of a work measurement program. The first attempt at the installation of a system in the Army had failed because inadequate time and effort had been devoted to work analysis, identification of meaningful work units, and the development of a reporting system. In addition three more mistakes which had been made were listed.

1. The so-called production standards had been hastily and arbitrarily set and were not true measures of effort;
2. The participation of operating people had not been utilized in developing the system;
3. The way had not been paved by enough evidence of top management backing and by line orientation before the plan was installed.[3]

The comments of the Army on standards are of interest because they differ from the view of the Navy Management Office. The Management Office advocates the development of Navy-wide standards.

The Army's comments follow:

The standard should be applicable to the peculiar operating differences which may exist among seemingly identical installations. While undesired variables in

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[2] A Work Measurement System (A Case Study), op. cit., pp. 40-41.

[3] Ibid., p. 6.

> the work itself should be eliminated, it is not always possible to achieve a high degree of uniformity. This may result in the setting of several standards for similar installations, depending on the degree of comparability which exists among any group of them. As long as significant differences in operating practice or working conditions are justifiable, differences in production rate are often justifiable also. Even as tentative production goals give way to true standards it is necessary to recognize those justifiable operating differences. Therefore, more than one standard may be established for an operation if the differences are of enough significance.[4]

The experiences of another Army installation, Rocky Mountain Arsenal, give an indication of the effectiveness of statistical standards.

> Statistical Standards had been in use for some time at the arsenal and performance against the Statistical Standard was approximately 100%. Top Management at Rocky Mountain Arsenal decided they were not satisfied with the average pace there or with what they were getting in terms of production for days work. They arbitrarily said that the average pace used at Rocky Mountain Arsenal was 65% and they cut their Statistical Standards to 65% of their original value. As expected, their performance fell to about 65%. No further changes were implemented. It was merely a case of redefining what constituted a day's work. During the 18 months following this change their performance rose from 65% to 82%. At the end of the 18 month period the trend of their performance was still steadily upward with no indication of flattening out. This was a 26% increase in their productive effort . . . resulting from establishing a new concept of normal.[5]

Abruzzi in a discussion of workers' reactions to standards set by time study points out that:

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[4] Ibid., p. 25.

[5] U. S., Department of the Navy, Bureau of Ships, Production Planning and Control Program Work Methods and Standards Course Instructor's Handbook (January, 1959), p. 81.

> Workers regulate their production rates during the time study so that the standard will be lenient and favorable to them; they also regulate their production rates after the study so that it has a fixed relationship to the standard. By these means the workers can easily make the standard appear accurate when it is in their interest to do so.[6]

It appears that the workers react to statistical standards in the same manner. If a lenient standard is set, the workers can be expected to regulate their production so that it hovers around 100%. Therefore, a standard set on the basis of average past performance does not offer much prospect as a management improvement device.

Even if this should be the case, the usefulness of statistical work measurement is not invalidated. Grillo and Berg defend its use in the office work measurement field in spite of its shortcomings.

> The use of past production records, supplemented by the judgment of supervisors who know the work, has two advantages--simplicity and low cost.
>
> Because they are simple, they can be applied in circumstances where a quick comparison is desirable between geographically separated but similar office organizations. If we have a simple index of work produced in widely separated branch offices, for example, or even in two firms engaged in similar work, it is possible to compare productivity. There is no need for elaborate analysis, just so long as we know that the units of work being counted are comparable and the work is reasonably uniform between offices.[7]

These authors seem to put their fingers on the key to the success or failure of any work measurement program in another statement.

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[6]Adam Abruzzi, Work Measurement (New York: Columbia University Press, 1952), p. 23.

[7]Elmer V. Grillo and C. J. Berg Jr., Work Measurement in the Office (New York: McGraw Hill Book Co. Inc., 1959), p. 117.

> Even a very crude index will work if the climate is right. If cooperation exists among top management, line supervisors and rank and file employees, if mutual confidence and understanding are present, any set of controls will operate within reasonable limits, even though some self styled expert may point out all sorts of technical shortcomings.[8]

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[8] Ibid.

CHAPTER V

THE ENVIRONMENT FOR WORK MEASUREMENT

The introduction of a work measurement program is seldom greeted with enthusiasm. Neither those who are to be measured nor those who are to do the measuring are receptive.

> People do not want to have their routines disturbed, and this is as true of supervisors as of the people they direct. A measurement program is calling on a supervisor to alter his thinking, to learn something new and to exert greater effort to assist in the installation of the program.
>
> It is only natural to be apprehensive of changes and controls which might demand effort and skills beyond one's competence. As time goes by, any supervisor in any organization tends to build up a little domain of autonomy, and outsiders are discouraged from trying to enter it. All human organizations tend with time to become static to a great extent, with a desire to preserve the status quo--and this is just as true at the top as it is of middle and lower management.[1]

Production workers have come to expect work measurement as a matter of course--whether they like it or not. But, a large proportion of the work the Navy intended to measure was not production work; it was administrative, clerical, and service type work which generally had gone unmeasured in both industry and government.[2] Not only was statistical work

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[1] Ibid., pp. 24-25.

[2] "Personnel Requirements Analysis in Administrative and Service Type Areas," Navy Management Review, IV, No. 1 (January, 1959), p. 18.

measurement a comparatively untested system, but the fields in which measurement was to take place were virgin.

It could be anticipated that even more resistance than normal would be encountered when this new group of employees were subjected to measurement. "The very idea that office work is standardized enough to be susceptible to measurement may itself be a blow to prestige, as compared with the blue collar or factory job.[3]

However, Grillo and Berg assert that most office work is measurable if too precise a factory type standard is not demanded for measurement. They also say that:

> It is common for a supervisor or clerk to maintain that his work or his department is different and too creative or variable for measurement. For example, at first glance correspondence work may seem creative and so may work on various types of claims for payment. But an analysis of such work will invariably reveal many repetitive recurring elements which fall into a routine pattern so that such work has been successfully measured.[4]

The apparent loss of prestige and the deflation of personal appraisal of one's work, which is involved in inaugurating an office work measurement program, plus the universal dislike for personal measurement will nearly guarantee that a new program will fail if it is not actively promoted and supervised. The following passage makes a good assessment of the chances for success.

> The backing of top management must be assured. If there is insufficient authority behind the program,

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[3]Grillo and Berg, op. cit., p. 26.

[4]Ibid., pp. 10-11.

> it will be hampered by those opposing it, and those wondering what management really think of the undertaking. Any indefiniteness will be sensed, and the program will drift because of apathy and passive resistance. This backing must consist of more than a memorandum or circular letter issued by an executive. It must be an active, lively interest in what the results will be or else the program will get nowhere.[5]

Industry has lately recognized the savings potential in the overhead area and has started to apply work measurement to overhead work for the purpose of tapping the potential. In doing so, it has run into resistance from the staff of the overhead departments. Richard Neuschel explains one of the reasons for the resistance.

> . . . outside the production area the level of expenditures provided for in a budget is essentially an arbitrary rather than a 'scientifically' determined amount. . . . the budget usually amounts to little more than a reflection of past performance, eloquently defended. It is arrived at by a process of negotiation in which the most articulate participant is motivated by personal incentive and a host of purely departmental considerations instead of by maximum contribution to company profits. In other words, budgets are usually subjectively determined by the very persons for whom they serve as standards of measurement.[6]

In other words, work measurement hits the overhead departments in the pocketbook. Budgets have to be justified with factual data; the usual outcome is a reduction in force and budget. The staffs of the overhead departments view this result with a jaundiced eye and are inclined to give less than their full support to work measurement.

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[5] Ibid., p. 18.

[6] Richard F. Neuschel, "Overhead Cost Control," The Management Review, III (March, 1958), p. 12.

It would be expected that when both management and the working force had feelings of hostility to a program, there would be a high incidence of failure or rejection of the program. A recent management survey of the Federal Agencies by the Bureau of the Budget confirms this expectation. The Bureau reported the following concerning the use of work measurement in the Agencies.

> Work measurement as a special activity was infrequently found at the agency level. Less than one third of the twenty five agencies covered reported work measurement programs of any consequence being carried out as a specific headquarters activity. The extent of work measurement programs reported ranged from well developed comprehensive systems to nominal promotional activity. Actual operation of programs, including analysis of reports for management's use and follow-up, was infrequently found.
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> Generally, strong agency leadership in the field of work measurement was absent. However a few agencies that had large scale repetitive or production type work gave considerable emphasis to the function and contributed significantly to the general development of the activity as a management tool. One possible explanation for the lack of attention to the activity in a number of agencies was the view frequently expressed that the agency's functions did not lend themselves readily to precise measurements.
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> Four of the agencies reporting work measurement activity called it by another name, such as performance analysis or performance standards. These names were adopted primarily to avoid terminology which it was believed had an unpopular connotation.[7]

The overall climate for work measurement appears to be cool at best.

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[7]U. S., Executive Office of the President, Bureau of the Budget, An Inventory of Agency Practices Concerning the Staff Function of Management Analysis--Management Analysis at the Headquarters of Federal Agencies, October 1959.

CHAPTER VI

THE STATUS OF CURRENT WORK MEASUREMENT PROGRAMS

The bureaus and offices of the Navy Department have now had up to fifteen years' experience in the use of statistical work measurement for management control purposes. This chapter will be devoted to a survey of the statistical work measurement programs currently in use in the various bureaus and offices. The form of each program, the uses which each serves and the evaluations of personnel associated with each will be covered. A brief description of the field activities managed by each bureau will also be included since this factor seems to have a bearing on the utilization of functional work measurement.

The Bureau of Supplies and Accounts Work Measurement System

The Bureau of Supplies and Accounts (hereafter referred to as BuSandA) is considered first because this bureau was the earliest to enter the field of statistical work measurement, and it has relied on the programs as management tools to the present day.

The field activities.--The Bureau of Supplies and Accounts manages major field activities which fall into three broad classifications--Supply Distribution Activities,

Commodity Control Activities, and Navy Purchasing Offices.

The Supply Distribution Activities consist of supply centers, supply depots, and supply departments at naval shipyards. The majority of the work functions performed within these organizations are common to all. Organizational comparability exists within each of the sub-classifications--centers, depots and shipyard supply departments.

The Commodity Control Activities are the supply demand control points--made up of offices such as the Aviation Supply Office and the Electronics Supply Office--the inventory managers of the various categories of material carried in the supply system. Here again there is a commonality of work functions performed by the offices, and it might be expected that their work performance could be evaluated by a common yardstick.

The same general statements hold true for the Navy Purchasing Offices.

The work performed at the Commodity Control Activities and in the Navy Purchasing Offices is paper processing, in one form or another, and the work of the Supply Distribution Activities is heavily weighted in the same direction.

The Bureau of Supplies and Accounts Work Measurement System consists of three work measurement programs, one for each of the three groups of activities discussed above. The programs measure the work performed by 41,000 employees. The Supply Distribution Activities employ 34,000 of the total, and the remaining 7000 are divided about six to one between the

Commodity Control Activities and the Navy Purchasing Offices.[1]

The use of work measurement by field activities.--The Bureau of Supplies and Accounts looks upon work measurement as one of the most important tools to bring about maximum output of standard quality at minimum cost per unit.[2] The reason that the Bureau regards work measurement in this light is explained as follows:

> Work measurement provides factual data on capabilities which makes it possible to estimate manpower requirements by specific functions necessary to accomplish the total mission and then derive the total monetary requirements to insure accomplishment of that mission.
>
> In management improvement work measurement will focus management attention on problem areas within an activity and permit selective corrective action.[3]

It is emphasized throughout the instructions covering the work measurement programs that their usefulness is dependent upon the extent to which local management exerts effort and interest in obtaining realistic data and in analyzing and using the data for management improvement.

The Bureau of Supplies and Accounts programs receive the criticism, which is common to all functional measurement systems, that the work units measured do not adequately reflect

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[1] Interview with Mr. M. Gray, Analyst, Work Measurement Section, Bureau of Supplies and Accounts, April 3, 1961.

[2] U. S., Department of the Navy, Bureau of Supplies and Accounts, NAVSANDA Publication 285 BuSandA Management Handbook, (June 1959), p. 5-1.

[3] Ibid., p. 5-2.

the work effort of the group being measured. The following comments are typical of the field reaction.

> All of the functions are measured against one work unit--the number of documents processed. The number of line items per requisition has no bearing, but it is obvious that the screening function is more time consuming for a requisition containing six items than it is for a single item requisition.
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> . . . . . .
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> Contract administration includes many variables not susceptible to accurate measurement--time spent in discussion with contractors over complaints on their service, receiving customer reports on the adequacy of contractor service, discussing collateral details and interpretation etc. While time spent in such activity can be carefully logged, it frequently happens that no work unit results. This fact makes production rates fluctuate widely and leads to loss of control.[4]

There is no easy solution to this general complaint against functional work measurement. Each increase in the number and detail of work units measured adds to the cost and complexity of the data collection and analysis. This can eventually destroy two of the desirable features of functional work measurement--simplicity and low cost.

On the other hand, if field activities are to be expected to use a system, they must have faith in its worth as a measurement device. Consequently, the Bureau has been sensitive to field complaints and has recognized the need for more refined measurements in many functional areas.

The impact of the refinements which have been made over the past ten years can best be illustrated by comparing the manuals covering the administration and reporting requirements

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[4]Robert A. Wells, "The Work Measurement Program--An Appraisal of its Use and Limitations in Management of a Control Division at a Non-Mechanized Activity," (unpublished professional paper on Supply Management, Bureau of Supplies and Accounts, 1958), pp. 18-19.

of the program in 1951 and that which is effective in 1961. The 1951 manual was a mimeographed publication of twenty-one pages. There were fifteen functional measurement areas defined with associated work units. A monthly report form was prescribed on which six items of collected data were reported for each of the 15 functional areas.[5]

The current manual covering the same subject is a printed publication of 253 pages. The work measurement program for Supply Distribution Activities, only, identifies 103 functions for which facts will be reported. Data concerning each function are reported on a separate report form. There can be as many as forty-seven items of information recorded concerning the performance of a single function. The average monthly report submitted by an activity is made up of eighty sheets in triplicate.[6]

The current reporting format was prescribed in June 1960. The new report represented a considerable increase in detail over the system in use prior to that time. A poll of users of the Bureau of Supplies and Accounts work measurement system indicates that most activities feel that the new reporting requirements have increased the effort required in the

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[5]U. S., Department of the Navy, Bureau of Supplies and Accounts, NAVSANDA Publication 61 Integrated Work Measurement Program for Supply, Manual of Instructions, June 1951.

[6]NAVSANDA Publication 285, op. cit., pp. 5-1--5-411.

preparation of the report but feel that the new report does not give them a more useful management tool. The increased effort was of such magnitude that the Bureau of Ships voiced its concern over cost:

> The significant effort required in the preparation of this revised report makes it mandatory that the shipyards be reimbursed for costs involved. . . .
> . . . . . .
> Costs involved in the preparation of reference b [Supply Management Report NAVSANDA 1143] would include the cost of accumulating data, typing, reproduction and other processing expenses.[7]

One respondent to a questionnaire on the work measurement program stated that as a result of the increased work involved in the preparation of the report, the practice of interchanging copies of reports between reporting activities for local comparison had been discontinued. Thus local management lost a management improvement device.[8]

These experiences depict the difficulties that can be encountered when a data collection and reporting system is refined or expanded too far.

The Bureau of Supplies and Accounts is now in the process of simplifying and mechanizing the data assembly and reporting procedures as a result of the reactions of the Bureau of Ships and the reporting activities.[9]

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[7]U. S., Department of the Navy, Bureau of Ships letter, subject: "BUSANDA Supply Management Report," December 27, 1960.

[8]Infra, p. 92. The results of a poll of Supply Distribution Activities conducted by the writer are tabulated in Appendix A.

[9]U. S., Department of the Navy, Bureau of Ships letter, subject: "BUSANDA Supply Management Report," 30 January 1961.

The BuSandA work measurement programs, though imperfect, are generally conceded to be useful aids to local management. One author observed, " . . . the day accountants can devise a balance sheet or graph which encompasses total reality, we can do without executives."[10] The implication of his article was that until such a development comes about, the effectiveness of any system will depend in large part on how the executives use it or supplement it.[11]

A user of the Bureau of Supplies and Accounts program commented on the need for supplementing the system: "The great volume of data available presents a problem of selection; that is, which of the relevant statistics should be isolated for evaluation and presentation to [naval supply] center management?"[12]

He then explains how the Naval Supply Center, Pearl Harbor solved this problem:

> Through the continuing analysis of work measurement and other statistical reports at NSC Pearl there has evolved a series of charts and data tables which rapidly inform top management of current and forecasted operations.
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> It has been found at NSC Pearl that achievement charts are most effective when reviewed in meetings of the Commanding Officer's Planning Council. On the 1st

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[10] Frank E. Jasinsky, "Use and Misuse of Efficiency Controls," Harvard Business Review, XXIV (July-Aug. 1956), p. 52.

[11] Ibid.

[12] P. W. Moore, Cdr., SC, USN, "The Use of Work Measurement and Statistics at a Naval Supply Center," (unpublished professional paper on Supply Management, U. S. Navy Department, Bureau of Supplies and Accounts, 1957), p. 3.

> Friday of each month the previous month's statistics are evaluated.[13]

The use of charts by local management is optional, but they appear to be a popular and effective way of condensing the masses of data generated and presenting the results for appraisal of top management. Trends of workload and performance and areas of excellent and sub-normal performance can be immediately detected when presented graphically; then attention can be focused where it is required.

One officer reported another use of charted data. He prepared graphical charts depicting the measured performance of his division from week to week. He posted these in the working spaces of his division and reported this result:

> Although measurement is on a group basis the counting of volume performed helps to satisfy the demand for recognition of the contributions of the individual within the group. This arouses the interest of the employee and sharpens his enthusiasm for his work. As long as his productivity goals are reasonable and, in his own mind, within reach, he can be expected to react favorably to the challenge of improving his performance. Team work, because of group measurement technique, is fostered.[14]

Accounts of employee cooperation and interest in work measurement are rather rare, however they are important factors in the success of the program. Commander Jeffrey after looking into the causes for unsatisfactory operation of the work measurement program in the Supply Department, Boston Naval Shipyard reported:

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[13] Ibid., p. 4.

[14] Wells, op. cit., p. 30.

> Perhaps the most serious problem in the entire program [Work Measurement] has been the lack of interest and understanding of the work measurement program on the part of employees and supervisors. The supervisory level was not interested and the working level accepted the program as a burden which must be tolerated as it has official approval. By many it was considered an additional unproductive workload.
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> This attitude created a response which quite naturally results in half-hearted application of methods and an abundance of errors in reporting and measuring productivity.
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> Faulty workload estimates coupled with doubtful production rates generated staffing requirements in which management had little confidence. In the field of management improvement work measurement indexes were regarded with suspicion. When a workload curve or a production rate curve sharply deviated from the normal pattern, this did not serve as a fire alarm to alert management because management recognized the unreliability of the data. Accordingly management's reaction usually concerned itself with straightening out the figures, which in turn straightened out the curve. . . .[15]

The above account might be called an illustration of "back-pressure effect." The negative attitude and apathy in the lower levels of the organization backed up and asserted itself at the top. It seems probable that the unpopularity of work measurement in many areas has come about as a result of this kind of action and reaction.

Jeffrey found other conditions which also militated against the success of the work measurement program. The job order system which was being utilized to collect material and labor charges had no relationship to the function being measured in the work measurement program. This situation was corrected by realigning the job order system with the work

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[15] R. P. Jeffrey, "Work Measurement in the Naval Shipyard," (unpublished professional paper on Supply Management, U. S., Department of the Navy, Bureau of Supplies and Accounts, 1957), p. 8-9.

measurement functions so that work measurement information could be collected by an already existing medium. The idea was not original--it was the prescribed method. By ignoring instructions Boston had made the collection of correct measurement data an additional, onerous task.[16]

Another example which emphasizes the need for employee training is cited:

> Another problem at this activity has been the inaccurate counting of work units. For instance one category of official mail representing a large volume of the S1.2 sub-function [O]ffice Services] workload had been excluded from the work unit count. This resulted in an unfavorable production rate which, upon investigation, proved to be inaccurate and was caused by a lack of adequate instruction in work measurement methods on the working level. In the traffic operations accuracy in counting and estimating measurement tons was poor. This work unit by its nature does not lend itself to finite accuracy. However, it was found that uniform standards were not used in calculating measured tons.[17]

The above examples demonstrate that there are many ways to compromise a work measurement program. The IBM people in explaining the capabilities of their electronic computers often use the expression, "garbage in, garbage out," to indicate that the output of the machine is only as good as the input. This is equally applicable to a work measurement program.

Since Boston was successful in converting an unpopular and meaningless work measurement program into an effective instrument of management improvement, it is believed that the recommendations of that activity concerning the administration of a work measurement program of the complexity and breadth of

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[16] Ibid., p. 8. [17] Ibid., p. 7.

that of the Bureau of Supplies and Accounts are worth quoting:

> It is recommended that responsibility for work measurement reporting and budget preparation work be confined exclusively to two or three individuals within the activity. Experience at Boston has proven that it is difficult and inefficient to spread work measurement reporting and budget preparation duties throughout the Planning Division. The parcelling out of duties resulted in no one understanding the entire work measurement reporting system or the budget preparation system. To overcome this fault it was decided that these two complex but related programs deserved the exclusive and entire attention of one management analyst and two assistants at the outset. This isolation of responsibility has in a short time been found rewarding beyond expectations and is recommended to other activities without reservation.[18]

The recommendation underlines the fact that the BuSandA work measurement program has lost one of the theoretical virtues of statistical work measurement--simplicity.

Jeffrey added two further prescriptions for the purpose of making work measurement useful at the local level:

> First, . . . local management must take the initiative and make constructive use of work measurement data. . . . Specifically it is recommended that top supervisors at the Branch Head level and above be drawn into the management team for the purpose of exploiting work measurement information.
>
> Second, the managing bureau should provide field activities with constructive ideas on methodology in employing work measurement data.[19]

The experience of Moore, Wells and Jeffery demonstrates that the usefulness of work measurement as a management improvement tool depends to a large extent upon the personnel using it. Effective management support and direction for the programs are the foremost requirements. Education of personnel and the development of correct procedures for gathering information and

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[18] Ibid., p. 22. [19] Ibid., p. 31.

measuring work units are also necessary elements of success. Additionally, it appears that the recommendations for centralized supervision of work measurement and budget by a management specialist or staff has merit. The development of local procedures for quick and pointed analysis of the measured results is nearly a must in the case of the Bureau of Supplies and Accounts system. The reports which are prepared for the Bureau are so voluminous and detailed that local management could not digest them without an inordinate amount of study. Finally, the local development of a vehicle by means of which the working people themselves can be informed of their progress and kept interested in the work measurement results should provide a climate in which management improvement can be realized.

The question, "Is work measurement an effective management tool?" can be answered only with, "It depends on how it is being used, supported and supplemented."

The use of work measurement in budgeting.--

> . . . it is in the area of budget formulation and execution that the Work Measurement Program makes its greatest contribution. Without work measurement statistics on which to base his projections, it would be virtually impossible for any officer . . . to make an intelligent approach to budget formulation.[20]

Wells' evaluation of the value of work measurement in budget formulation is fairly well supported by officers who are currently using it for that purpose.[21]

There are two features in the BuSandA Work Measurement

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[20] Wells, op. cit., p. 31. [21] Infra, p. 92.

System which facilitate its use in budgeting. The first is the integration of the work measurement functional areas with the cost accounting system; the second is the integration of the work measurement functions with the budget format, i.e. the budget is formulated and executed on functional lines which parallel work measurement functions.

The integration of the cost accounting system with the work measurement system makes it possible for field activities to collect costs of performance of functions using an already existing media, the job order cost accounting system. The ease of collection of functional costs makes it feasible to report monetary performance data as well as work performance data on the monthly work measurement report. Since the Bureau of Supplies and Accounts managed activities are budgeted on functional lines, local management and the Bureau receive a detailed monthly report of budget execution in the work measurement reports.

The field activities submit semi-annual requests for operating allotments to the Bureau which they must justify by forecasting anticipated workload, work performance, and costs for each work measurement function. The Bureau is able to analyze the requests by using the current year's work measurement reports which reflect workload trends as well as rates of performance and expenditures per function. If the Bureau arrives at a different conclusion concerning the projected requirements than that reached by the field activity, the latter must plead its case using work measurement data as

evidence.

The potence of work measurement in budgeting is illustrated by the fact that until 1960, the Comptroller of the Bureau made a unilateral decision on the level of funding of each reporting activity on the basis of reported work measurement data. This practice has been changed during the past year. The Bureau Program Managers, who supervise the field activities operations, now review the work measurement reports and recommend a level of funding to the Comptroller. The review by the Program Managers insures that factors which do not appear in past work measurement reports, such as planned projects or changes in the status of current projects, which might have a bearing on future workload are taken into consideration. In any case, however, the work measurement reports are a powerful budgetary tool.[22]

Limitations of the BuSandA Work Measurement System.-- There are a number of features in the Bureau of Supplies and Accounts Work Measurement System which limit its usefulness in both budgeting and management.

Wells defined one limitation in the following manner: "The use of Work Measurement Program in budget formulation and administration is creating some new problems. The work force has become increasingly conscious as to what counts and what does not count, and have little time or respect for

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[22]Interview with Captain Robert J. Everett, SC,USN, Deputy Comptroller, Bureau of Supplies and Accounts, February 27, 1961.

unmeasured functions."[23]

The so-called collateral work, or the work which does not contribute directly to the production of the measured work unit is just as essential to the proper performance of a function as that which is directly involved in the production of the work unit. However, if the funded ceiling for personnel is to be based on the work unit production, it is only natural that the work which produces these work units would receive most attention. Eventually the slighting of the collateral work will be reflected in quality measurements but in the meantime production figures will look good. The distribution and employment of personnel within the functional work areas cannot be measured or controlled by work measurement.

Perhaps the most serious limitation in the system is the absence of meaningful comparative standards. Though separate work measurement programs have been tailored to fit the three classes of fairly homogeneous activities, the Bureau of Supplies and Accounts has never developed Navy-wide standards of performance against which to measure the reported work performance of the activities it manages. Each activity is measured against its own past performance. Its forecasts of future workload and future performance are also based on its own past performance. The reason given for the omission of Navy-wide standards is:"activities are different." This has been borne out by inspections and activity analyses. Differences in organizations, work-mix, and facilities between

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[23]Wells, op. cit., p. 43.

individual activities cause uncontrollable variations in the performance of work. The degree to which these differences should affect the performance has not been determined because of the complexity of making such an assessment. Therefore meaningful inter-activity comparisons cannot be made on the basis of work measurement reports.[24]

In an effort toward getting some uniformity in production rates the Bureau periodically distributes a list of actual functional workload and production rates achieved by all reporting activities. Each organization is encouraged to compare its operations, rate-wise, with the system-wide operations. It is felt that knowledge of system-wide data should contribute to better local evaluation of productivity, better reporting, and ideas for eventual improvement of the work measurement system. Local managers are advised that low production rates in comparison with others should serve as a basis for objective re-examination of operating procedures to determine if production can be increased.[25]

The absence of meaningful standards with which actual production may be compared makes it impossible for reviewing authorities to arrive at objective evaluation of performance. Table I, a selected listing of activity production rates for the same work functions during fiscal year 1960, illustrates that there are sometimes variations in production rates of

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[24]Interview with the Deputy Comptroller, Bureau of Supplies and Accounts, February 27, 1961.

[25]NAVSANDA Publication 285, op. cit., p. 5-6.

TABLE 1

SELECTED LISTING OF PRODUCTION RATES FOR WORK MEASUREMENT FUNCTIONS REPORTED BY SUPPLY DISTRIBUTION ACTIVITIES DURING FISCAL YEAR 1960

Reporting Activity	Work Measurement Function	Work Unit	Production Rate (Work Units Per Man Hour)
Naval Supply Center, Norfolk	Office Services	Mail	45.81
Naval Supply Center, Oakland	" "	"	23.09
Naval Shipyard, Mare Island	" "	"	14.91
Naval Supply Center, Norfolk	Printing and Reproduction	Masters	27.92
Naval Supply Center, Oakland	" " "	"	3.94
Naval Supply Center, San Diego	" " "	"	14.29
Naval Supply Depot, Philadelphia	Stores Accounting	Documents	2.87
Naval Supply Depot, Great Lakes	" "	"	19.69
Naval Supply Center, Norfolk	Cost and Appropriation Accounting	Documents	7.86
Naval Supply Center, Oakland	" " "	"	19.58
Naval Supply Center, Norfolk	Incoming Waterfront Operations	Measurement Tons	4.75
Naval Supply Center, Oakland	" " "	" "	1.65

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[26]U. S., Department of the Navy, Bureau of Supplies and Accounts, BUSANDA Notice 5220, October 27, 1960.

as much as 800 percent between activities.

No specific explanation for large variations in production rates could be found. The writer was informed that there was some doubt as to the validity and value of work measurement reporting in the fiscal services field, where a number of large variations occur, and that possibly some action would be taken either to revise the reporting for this function or to discontinue measurement altogether. Some large variations had been investigated in the past, and local conditions had been found to have a marked affect on productivity rates. Therefore extreme differences in productivity between activities are not considered unusual. However an appreciable variation of the productivity rates within a field organization from one reporting period to the next requires explanation.[27]

Not only the Bureau is limited in evaluating effectiveness, but the local manager also finds himself at a loss. Wells voiced the quandry of the local manager:

> Among the questions that cross a manager's mind in reviewing his performance, as portrayed by the Work Measurement Report, is 'Are these standards reliable?' Even when performance is good--when planned production rates have been met--there still remains the knowledge that 'This is what has been done' and the doubt 'Is this all that could have been done?'[28]

Current developments in Bureau of Supplies and Accounts work measurement.--The Bureau has long recognized the

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[27] Interview with Mr. M. Gray, Work Measurement Section, Bureau of Supplies and Accounts, April 3, 1961.

[28] Wells, op. cit., p. 39.

deficiencies in a purely historical work measurement system and has conducted studies at selected installations to ascertain the feasibility of developing individual job standards through the application of Engineered Performance Standards (hereafter referred to as EPS).

The Naval Supply Depot, Bayonee, New Jersey was the site selected for the first pilot study in 1954. The installation of EPS at Bayonne was completed in 1955, but the hoped-for improvements in performance and measurement did not materialize. A commentary on this early effort and the lessons derived from it was published in the Navy Management Review in 1959.

> In prosecuting its program, [EPS] the bureau has made its share of mistakes. In the early days of the program standards were considered of paramount importance. This emphasis was a result of the need for training personnel in applying standards and the sense of urgency to provide better costing factors than previously available. As a consequence, many of the early operations did not achieve adequate job and methods engineering prior to standards settings. Consequently, total productive benefits were not attained and it was necessary to rework jobs. Additionally a new production report came into being to accommodate reporting of engineered standards, while the previous statistical standard reporting system was maintained.[29]

The lack of success with the early pilot installation of EPS coupled with other factors inherent in such a program caused a slow down and de-emphasis of the effort by the Bureau. Specifically the factors which were considered unfavorable to its further development were:

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[29]"Methods Engineering (EPS) in BUSANDA," Navy Management Review, IV (December 1959), p. 18.

(1) The time, efforts and costs required for training, installing, measuring and rechecking standards.
(2) Antipathy toward individual time standards.
a. Fear of job loss on part of employees.
b. Dislike of reflection upon supervisory effectiveness.
(3) Reluctance to undertake the effort and cost of establishing "another performance measuring system."
(4) Lack of top management interest--initial savings pointed up by pilot Engineered Time Standard studies were largely discounted or dissipated at the activity level.
(5) Absence of compelling budgetary pressure.[30]

Though the Bureau "back-watered" on the installation of EPS in its managed activities, it continued to search for more effective management improvement devices for use in the field organizations. It inaugurated a Methods Improvement Program for the purpose of discovering more effective working methods by systematic study. In this program management analysts at the field activities subjected present methods of doing jobs to a searching analysis and then considered the possibilities of applying practices of known effectiveness in their stead. Results were evaluated in a BUSANDA Instruction:

> While the results have been most gratifying, certain deficiencies have existed. These have been, a lack of precise means to measure the effectiveness of existing work methods and processes, lack of technique to predetermine the advantages of proposed improvements in methods and procedures prior to their acceptance and installation, and a need for determining production standards which measure actual productive capacity.[31]

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[30]Robert J. Everett, "Integration of Work Measurement and Engineered Time Standards--A Giant Step in More Effective Management," (unpublished professional paper in Supply Management, U. S., Department of the Navy, Bureau of Supplies and Accounts, 1960).

[31]U. S., Department of the Navy, Bureau of Supplies and Accounts, BUSANDA INSTRUCTION 5200.7, August 6, 1959.

It was apparent that reliable standards plus a more precise measuring technique were required for objective assessment of performance. Therefore, another study of pilot installations at Mechanicsburg--the Naval Supply Depot, the Ships Parts Control Center and the Ordnance Supply Office--was conducted. Lessons learned at Bayonne were not forgotten. "Make haste slowly" was the watchword. Trained analysts studied methods and applied methods improvement techniques before attempting to set standards on any job. (At Bayonne standards had been set on the basis of existing methods). Selected personnel from the activities participating in the new pilot installations were given extensive training in methods analysis and the techniques of developing job standards. They worked under the supervision of experienced analysts from the Bureau's Management Engineering Office in learning to apply their classroom instruction. Supervisory personnel at the activities were given a short indoctrination course in the principles of the Methods Engineering Program and shown how it could be used to their benefit.

As a result of the latest pilot studies the Bureau is convinced that methods and job engineering, combined with engineered standards, can be applied to approximately 80 percent of the supply functions to a distinct advantage. There is reliable evidence that from 30 to 50 percent improvement in performance can be achieved in many jobs.

The promise and potentialities of the Methods Engineering Program are so attractive that the Bureau of Supplies and

Accounts has set a target date of 1963 for 100 percent coverage of its managed activities. The process of implementation of the program at an activity is relatively slow and costly. Personnel from the activity are first carefully selected and given aptitude examinations to determine their suitability for analysis work. They then attend a seven week classroom course taught by personnel from BuSandA's Management Engineering Office. Following the course they serve a four to six months apprenticeship in their home activity under the direction and guidance of Bureau analysts. When the new analysts have developed proficiency in methods analysis and engineered standards development, the Bureau supervisor moves to another activity to assist in the establishment of a new program.

There will be 181 methods engineering analysts employed in the field activities when all activities have been covered by the new program. Their duties will consist of reviewing and improving methods and standards and providing staff assistance.

It is not intended that EPS will displace the functional work measurement program, rather they will supplement it. On the local level the standards will provide a more accurate and finite scale for planning and gauging individual, or small segments of functional effort. They will, it is hoped, eliminate the perennial complaint against functional work measurement: " . . . he needs more to manage--more refined information, more immediately available information, better indication of where he is and how well he is doing, and a means for spotting trouble at its inception."[32]

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[32] Wells, op. cit., p. 47.

The unique feature of the Bureau of Supplies and Accounts Methods Engineering Program is the integration of the engineered standards with the functional work measurement program. Other bureaus, when they have adopted engineered standards, have generally discontinued their functional programs. The Bureau of Supplies and Accounts is retaining the functional program because it gives top management a good overall view of performance, and it is also much more useful in budgeting than EPS.

The integration of EPS into the functional work measurement program is expected to be a gradual, step-by-step process. Each field activity will develop its own engineered performance standards for individual jobs. Then using the individual job standards as building blocks they will construct yardsticks for the group work measurement functions. The resultant will be a composite engineered performance standard for a broad functional area. At first each activity's performance will be measured against the standards developed by its own methods engineers.

Copies of the work sheets used to develop the activity standards will be forwarded to the Bureau Management Engineering Office where they will be reviewed and inter-activity comparisons made. When the standards for like jobs show significant differences, an effort will be made to determine the reason for the differences. It is expected that the investigation of variances will turn up many improved methods and procedures which may be transferred between activities with little or no adjustment thus providing Navy-wide methods improvement. In

addition to reviewing the individual job standards, the Bureau will be able to analyze differences in the field activity functional yardsticks which have been constructed from the individual standards. The Bureau will be able, for the first time, to determine objectively how much variation between the productivity of one activity and that of another is due to uncontrollable local conditions. It will have meaningful, scientifically developed standards which will tell how much should have been done against which to measure what has been done. Eventually, it may be possible to develop Navy-wide EPS-based functional standards. The determination of the feasibility of this action will have to await experience developed as the Methods Engineering Program is implemented on a wide front.[33]

The experience of this Bureau would seem to indicate that statistical work measurement is a crude tool of management. Even when extensively refined, it leaves many gaps in measurement and control, both at the local level and at the top management level. The room for improved management through the development and maintenance of engineered job standards is so great that the Bureau of Supplies and Accounts is committed to a program which will cost over one million dollars a year in Methods Engineers salaries alone when it is fully implemented.

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[33] Interview with D. Markoff, Head, Methods Engineering Division, Management Engineering Office, Bureau of Supplies and Accounts, April 3, 1961.

Office of the Comptroller of the Navy Work Measurement Programs

The discussion now shifts from "big business," Bureau of Supplies and Accounts managed field activities, to "small business," field activities managed by the Office of the Comptroller of the Navy. The comparative descriptions of the two are considered appropriate in view of the differences in the number employed, the physical plants maintained and the number of functions performed by each.

The field activities managed by the Comptroller are comprised of nine Navy Regional Accounts Offices (hereafter referred to as NRAO), sixteen Navy Accounts Disbursing Offices (hereafter referred to as NADO) and the Navy Finance Center, Cleveland, Ohio. The work performed in all these activities is exclusively paper processing. A fundamental description of the work carried on and the total number employed by each type activity follows:

Navy Regional Accounts Offices employees--1321	(1) Audit, pay and examine dealers and contractors bills (2) Perform cost and appropriation accounting (3) Review property returns submitted by Navy activities
Navy Accounts Disbursing Offices employees--947	(1) Maintain pay accounts of military personnel (2) Perform disbursing functions for military personnel
Navy Finance Center, Cleveland employees--859	(1) Acts as central office of the Navy pay system. Performs disbursing

functions which cannot be accomplished in the field such as personal allotment administration, allotment check preparation and distribution and retired pay payments.

(2) Acts as a central clearing house for field disbursing officers.

The Office of the Comptroller, like the Bureau of Supplies and Accounts, has three work measurement programs, each designed to fit one of the classes of managed activities. Unlike the Bureau, however, the Comptroller reporting systems are characterized by a limited number of functional breakdowns and a brief and simple reporting format.

The NRAOs report five items of measured data for each of nineteen functional work areas. However, even in so simple a report some difficulty is encountered in the collection and reporting of data. A NavCompt Notice addressed to the NRAOs seems to carry the implication that the field offices have little interest in collecting work measurement data for their own use.

> Since inauguration of the present NRAO Work Measurement Program on 1 July 1959, visits have been made to various NRAOs and local procedures and systems in accumulation of statistics have been analyzed, particularly the method utilized to prorate man-hours between Function 501, Sundry Dealers Bills, and Function 502, Contract Dealers Bills. Analysis revealed that man hour proration was normally accomplished on a predetermined basis, most often based on past month rather than on current month work units, resulting in inaccurate production rate and cost reporting. In view of the importance of these functions, all activities are urged to ensure that man-hours . . . are prorated on the basis of related work units accomplished during each month. . . .[34]

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[34] U. S., Department of the Navy, Office of the Comptroller, NAVCOMPT NOTICE 5220, June 21, 1960.

The above account seems to indicate that the field offices tend to prepare reports merely to fulfill a reporting requirement. If the field activities do not use the information which they collect and report, the same cannot be said for the Office of the Comptroller. The Management Section Heads in the Comptroller's Office who supervise the operations of the NRAOs and the NADOs analyze each monthly report. They transcribe the data from the individual reports to functional spread sheets which are kept handy on their desk tops. (The dog-eared appearance of these records indicated that they are used frequently). The spread sheets contain information covering each functional area for a twelve month period; they enable the Section Heads to detect workload and performance trends and to make inter-activity comparisons at a glance.

Standards of work performance have not been developed for the NRAOs. Even though these organizations seem as alike as peas in a pod, and the work they perform the same except for volume, they are not considered susceptible to meaningful measurement by a single set of statistical standards. It has been determined by means of personal visits and inspections that local conditions such as office layout, office equipment, work-mix and total number in the work force have a bearing on production rates. Consequently a good standard for one office would not be good for another. Therefore the performance of each office is evaluated only against its own past performance.

Since there are only nine NRAOs, the Head of the NRAO Management Section has become personally acquainted with the

operations of each through field visits. He has investigated areas where work measurement results indicate abnormal performance and has been able through this means to identify valid causes for variations between the work results of one office in comparison with others. The intimate knowledge which he has accumulated concerning each installation enables him to analyze reports with more acumen than most of his counterparts in larger bureaus and offices.[35]

The work measurement program for the NADOs has a simple, concise reporting format similar to that used for the NRAOs. This program, however, does provide performance standards in the form of "staffing ratios." A staffing ratio expresses the number of work units required to justify the employment of one person. For instance, the staffing ratio for the function "Enlisted Pay Accounts Maintained" is 300 pay records per employee. If an office maintained 1500 enlisted pay accounts, it would be allowed five employees to perform the work. There are eight separate staffing ratios, one associated with each function performed by the NADOs.

Since the NADO Work Measurement Program and the staffing ratios were established in 1959, it has been possible to reduce the number of employees in the NADOs by 20 per cent. The reduction came about despite an increase in workload and is attributed entirely to the establishment of a useful yardstick

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[35]Interview with Mr. Murry Beltzer, Head, Navy Regional Accounts Management Section, Office of Assistant Comptroller of the Navy for Accounting and Finance, March 24, 1961.

against which production could be measured.[36]

It should be noted that the work performed in the NADOs is completely standardized. The functional areas measured are extremely narrow; the work units measured actually represent total work output of the functional group. Such conditions are favorable to the development of a system-wide standard. A parallel to this kind of operation is very rare in the Navy.

The work measurement reports for the Navy Finance Center are useful only in comparing current performance and work load against past. No standards have been developed for the Center program. The Navy Finance Center is a unique entity so there is no possibility of inter-activity comparison. The program has limited value as a management control tool.[37]

Staffing levels at the NRAOs and NADOs are the only significant factors used in determining budgets. Materials and utilities expense are minor items and are considered to be fixed. Work measurement data is used almost exclusively in formulating, justifying and executing the Comptroller's budget for field activities. (It should be mentioned that on each work measurement report submitted, the field activities report the average annual salary of the employees.) The heads of the

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[36] Interview with Mr. J. O. Billodeaux, Head, Navy Accounts Disbursing Office Management Section, Office of the Assistant Comptroller of the Navy for Accounting and Finance, March 24, 1961

[37] Interview with Mr. Marvin Smith, Head, Navy Finance Center Management Section, Office of the Assistant Comptroller of the Navy Accounting and Finance, March 24, 1961.

three Management Sections in the Office of the Comptroller review field requests for allotments against measured past performance and current work trends. They then establish the staffing and funding levels for each office.

The close management supervision and intimate acquaintance of the Washington managers with all phases of field operations adds to the utility and significance of the work measurement reports. Under the conditions existing in the Office of the Comptroller, work measurement proves itself a useful budgetary and management tool; it also maintains the desirable characteristics of simplicity and low cost.

The Bureau of Naval Personnel Work Measurement Programs

One aspect of the Navy Department that is brought home to one who is making an across-the-board survey of its bureaus and offices is the diversity in organizations, missions and personalities among and within the segments of the Department. The Bureau of Naval Personnel (hereafter referred to as BuPers) and its field organizations, for instance, have few, if any, likenesses to either the Bureau of Supplies and Accounts or the Office of the Comptroller and their respective organizations. Additionally, the field organization managed by BuPers is a kaleidescope of 288 activities ranging from Recruiting Stations manned by four individuals to the Naval Training Center, Great Lakes where 760 are employed. There are numerous unique organizations in the Bureau's family of activities; each performs a specialized function. As an illustration of the diversity of

these organizations the following examples are cited: U. S. Naval Academy, Annapolis, Md.--Naval Home, Philadelphia, Pa.--Family Allowance Activity, Cleveland, Ohio--Navy Motion Picture Service, Brooklyn, N.Y.--Correspondence Course Center, Scotia, N. Y. and Anti-Air Warfare Training Center, Dam Neck, Va.

The Bureau of Naval Personnel has twelve different work measurement programs--each adapted to a particular type activity or to a common service function, such as Supply, which is performed within a number of activities. This phalanx of work measurement systems succeeds in measuring the performance of only 59.6 per cent of the 8370 civilian employees paid from Bureau of Naval Personnel funds. In contrast, the Bureau of Supplies and Accounts system measures about 95 per cent of its total employees which the Comptroller's Office has 100 per cent coverage in its field organizations.

For the most part the Bureau's monthly work measurement reports are simple one page reports which provide a minimum of basic data. The report for the Family Allowance Division is the most basic--it provides for reporting of performance of two functions using the same work unit, "1 action or piece of mail" to measure productivity of both functions. Some reports provide for the reporting of only man-hours expended in a number of functional areas. The Training Aids Work Measurement Report, for example, identifies eleven functional work areas for which man-hours expended will be reported, but only five areas include a count of work units completed. In other words, over one half of the report is devoted to labor distribution, not work

measurement. This condition exists because work output cannot be expressed in standard work units. Functions such as "Art Preparation" and "Model and Mock-up Fabrication" produce nothing that could be equated to a common denominator.

Standards of performance are included in some reporting programs. The standards are based on the average production rate for a six months' period. There is a proviso that they will be reviewed periodically and adjusted if it appears necessary. A BuPers instruction states that a fifteen per cent variation between actual production and the standards is considered normal.[38]

A sampling of the reports in the files of the Bureau revealed consistent variations from standard of 150 per cent in the performance of fiscal functions for a period of six years. The standards set in 1954 are still being used.

Mr. McHale, Head of the Management Services Branch, BuPers explained that only limited time was devoted to the Work Measurement Program in the Bureau. One employee spends part of her time in receiving and filing incoming reports and preparing a quarterly summary of work measurement data. No attempt is made to analyze the reported work accomplishment. An analysis of twelve different kinds of reports from a variety of sources is not considered realistic. Therefore, the Work Measurement system is essentially a means of collecting some factual data which is used to a limited extent in arriving at

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[38] U. S., Department of the Navy, Bureau of Naval Personnel, BUPERS INSTRUCTION 5220.4, March 25, 1954.

decisions concerning the distribution of personnel among activities.

McHale rated the work measurement data as useless in budget formulation. He explained his evaluation by pointing out that budget ceilings were set without regard for work measurement information.

Though the Bureau makes limited use of work measurement in management or budgeting, the field activities, when they request allotments, are required to justify their staffing plans by forecasting detailed workload and performance with data derived from work measurement reports.

Mr. Hatcher, Head of the Manpower Branch, Comptroller Division expressed the belief that the requirement for work forecast in support of requests for operating funds gave work measurement status in the eyes of local management and also served as a reminder to the field of the necessity for continuous appraisal of workload and production. He also considered that the preparation of the monthly work measurement report proves useful in focusing local management's attention on areas where abnormal results are reported.[40]

The consensus on work measurement in the Bureau of Naval Personnel seems to be that the systems in use provide a limited amount of useful data at low cost, and they spur local

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[39] Interview with Mr. A. P. McHale, Head, Management Services Branch, Bureau of Naval Personnel, March 22, 1961.

[40] Interview with Mr. W. F. Hatcher, Head, Manpower Section, Comptroller Division, Bureau of Naval Personnel, March 22, 1961.

management into investigating conditions requiring attention. No plans are afoot to expand or refine the system any further since such action would involve additional costs which cannot be justified.

The Office of Naval Material Work Measurement Program

The Office of Naval Material is assigned the responsibility for the operation and administration of the forty-one General Inspection Offices of the Material Inspection Service, U. S. Navy. These offices verify the quality and insure timely delivery of material procured from Industry at a fair and reasonable cost. The work performed by the offices is the same except for volume.

The Office of Naval Material made the following report concerning budgetary problems:

> Early in 1957 the General Inspection Offices were experiencing rising operational costs and declining overall workload. This situation appeared to stem from three factors:
>
> (1) failure to fully adjust manpower levels to post-Korea requirements;
> (2) failure to offset increased personnel requirements of new offices and those offices having an increase in workload by a reduction in the number of offices and manpower in areas of declining workload; and
> (3) the method of reorganization of offices to cope with problems stemming from the ever-increasing complexity of materials and weapons.
>
> Immediate action was necessary to bring operational costs into line with overall workload assignments of each office. Over 90% of the budget of the General Inspection Offices was allocated to civilian salaries. It was apparent from this fact that a reduction in operational costs would necessitate a reduction in civilian personnel. The problem was how to effect this reduction and still maintain a high degree of performance and customer service. The solution lay in the development of a management program that could pin point those offices and functions that were staffed in

> excess of actual requirements. Such a program should also serve a continuing purpose, beyond correcting the immediate problem. For having achieved a balance between workload and working force, the program must serve to retain that balance.[41]

Having identified the problem and what had to be done, the Office of Naval Material proceeded to develop what has come to be known as "FAME" (Functional Analysis of Manpower Expenditure), a program of work measurement and manpower utilization. FAME seems to embody all the desirable characteristics of functional work measurement--easily collectible work units, simple reporting format, and effectiveness.

The success of the program can be traced to the care which was exercised in designing it.

> Several work units were tried for each organization or function, and each was carefully tested by statistical methods for reliability as a measure. Some work units had to be weighed to take into account varying degrees of difficulty of execution. All work units both test and final selection, were suggested by or checked and approved by field and departmental personnel having experience in organizations and functions being considered.[42]

The development of standards of performance which would be universally applicable required extensive analysis of past performance data. Statistical processes and graphic correlation techniques were used to identify valid standards. When the "norms", as they are called in FAME, were established, the program was inaugurated.

The procedure for reporting and evaluation of performance

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[41] U. S., Department of the Navy, Office of Naval Material, FAME, June 1960, p. 1.

[42] Ibid., p. 2.

in this work measurement program are singular. The field offices report raw production and work data. The Office of Naval Material processes the raw data on electric accounting machines to convert it to weighted work units. The performance of the Office is then analyzed by machine.

Each Inspector of Naval Material receives an analysis of the performance of his office. The analysis compares actual hours spent on each measured function with the number of hours which should have been spent.

The instructions covering the interpretation of the analyses state that it is not necessary that the number of hours expended in performing each function should equal or be less than the standard number of hours allowed for that function; however, the total number of hours expended on all functions must not exceed the total number of hours allowed for standard performance. When the total actual hours do exceed the allowed hours, the instruction advises: "Over norm results [actual hours in excess of allowed] in excess of one man quarter are indicative of overstaffing, improper working procedures, and unnecessary duties and tasks. This is particularly true if the function has measured over norm for two or more quarters."[43]

There is little room for doubt that management action is expected when an office performs below norm. This expectation is affirmed by the policy statement of the Chief of Naval Material which follows:

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[43] U. S., Department of the Navy, Office of Naval Material, ONM Instruction 5220.3A, June 28, 1960.

a. The Office of Naval Material will use work measurement in evaluating the performance of field activities and in verifying the validity of requests for operating funds and personnel ceilings. The attention of Supervising Inspectors of Naval Material, Inspectors of Naval Material, and Resident Inspectors of Naval Material will be directed to areas that indicate a need for improvement.
b. The Supervising Inspectors of Naval Material shall use work measurement data as a means of fixing areas of operations requiring staff attention and of determining manpower and fund requirements. Action shall be taken to assist field activities in correcting uneconomical performance in a prompt and positive manner.
c. The Inspectors of Naval Material . . . shall use work measurement to determine functional areas requiring close supervision and administrative action. Prompt local action shall be taken to correct imbalanced staffing.[44]

This statement of policy is the most positive and dynamic endorsement of a work measurement program in the Navy.

The measurable results of FAME program have justified the work that went into its development and the support it has received.

In the 30 months that the FAME program has been in existence, civilian personnel have been reduced from 5153 to 4278, a difference of 875. It is particularly significant here, that during this period workload gradually increased both in quantity and complexity. This reduction in personnel represents annual payroll savings of $5,075,000.[45]

The Bureau of Yards and Docks Work Measurement Programs

The work performed under the management and technical control of the Bureau of Yards and Docks is essentially different from that of the bureaus and offices considered to this

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[44] Ibid.

[45] FAME, op. cit., p. 8.

point. The preponderance of work under the cognizance of the Bureau of Yards and Docks is performed by "blue collar" workers whereas that supervised by the others is heavily weighted by the "white collar" class. The management responsibilities of the Bureau can be divided into two major segments--the supervision of new construction, and the maintenance and repair of shore facilities. The major portion of the new construction is performed by contractors under Bureau inspectors' surveillance, while the maintenance and repair is performed primarily by employees of the Navy under the supervision of a Civil Engineer Corps officer.

The Bureau of Yards and Docks was one of the leaders in the development of functional work measurement. Its program was used to evaluate work performance in the maintenance and repair area. The program appeared to be effective even when it was in early stages of development. The Public Works Officer of the Naval Shipyard Pearl Harbor made the following comments in a letter written in 1949.

> The Work Measurement Program at this activity has served the Public Works Officer as a management tool in the following respects:
>
> (a) It forecasts and justifies personnel requirement.
> (b) It assists in the preparation and justification of quarterly budgets by determining how economically manpower is expended.
> (c) It calls attention to organizational components whose performance warrants investigation.
> (d) It measures effectiveness of improvement made.
> (e) It assists in the establishment of a planned maintenance program.
> (f) It compares specific categories of work with other activities.
> (g) It provides a guide for any desired graduation

of performance required.[46]

He then proceeded to give examples of action taken and benefits realized as a result of information derived from the Work Measurement Program:

> Railroad service in the Shipyard is not being fully utilized; therefore, the only possible answer is the eventual elimination of railroad service. However, placing this equipment on a call basis has improved economy to some extent.
>
> Investigation of the high utilization index on maintenance of waterfront structures revealed that work had been neglected over a period of time, in favor of what appeared more urgent projects. To correct this situation, a planned maintenance schedule has been established to fully utilize the personnel and heavy equipment involved.
>
> . . . . . .
>
> It is estimated that the cost of preparing the Work Measurement Report does not exceed $75.00 per report. The savings resulting from the Work Measurement program for the past six months is estimated to be in excess of $20,000.00.[47]

The Bureau of Yards and Docks refined and revised its work measurement program as experience was gained. Statistical standards were developed and were revised periodically to keep them current.

There is evidence, however, that there was resistance to full application of the work standards in the staffing of field activities. The findings of the On-Site Survey Division of the Office of the Naval Inspector General is a survey of the First Naval District are illustrative:

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[46] Letter from S. P. Zola, Public Works Officer, U. S. Naval Shipyard, Pearl Harbor to Records Management Officer, Fourteenth Naval District, April 27, 1949.

[47] Ibid.

> BUDOCKS Work Measurement Summary of Public Works type functions at Portsmouth Naval Shipyard, for the period 1 July 1954 thru 30 June 1955, show that the actual man years employed on measured functions was 112 in excess of standard. . . . The survey indicated an urgent need for management tools which can be used to determine current and future manpower requirements. It further showed that Work Measurement Data is not being utilized effectively by either the Shipyard or BUSHIPS.
>
> . . . . . .
>
> BUDOCKS Work Measurement Evaluation of Public Works type functions at the Boston Naval Shipyard for the period 1 July 1954 to 1 July 1955 showed 153 more man-years charged to the various sub-functions than standard.[48]

When deviations from standards occurred, the field activities questioned the accuracy of the standards. The comments of Portsmouth Naval Shipyard on the findings of the survey are typical.

> PORTSMOUTH NAVSHIPYD: Does not concur. It is believed that the recommendation [for reduction in personnel] is based primarily on work measurement, and that this report, particularly in the period referenced, does not present an accurate picture.[49]

Complaints concerning various aspects of the work measurement program flowed into the Bureau in a steady procession. Some attacked the performance standards, or staffing ratios, as invalid. Others criticized that there was no way to "beat" work measurement when it was used in budgeting. They pointed out that if an activity was below standard in its performance, it was budgeted on the basis of the standard.

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[48] U. S., Department of the Navy, Executive Office of the Secretary, "Extracts from reports on a survey of the First Naval District by the On-Site Survey Division, Office of the Inspector General of the Navy in 1955," on file in Navy Management Office.

[49] Ibid.

Thus in order to perform its projected work load, it had to increase its performance. On the other hand, if an activity performed above standard, it was budgeted on the basis of its actual performance. It was then necessary that its performance remain above the standard if it were to accomplish its planned work load in the future. It was felt that such a system of budgeting invited "fudging" of reports because there was no incentive to report better than standard performance.

Another facet of the program that came under fire was a weakness in the cost collection system. The work measurement functions were not matched with the accounting classifications against which costs were collected. As a result, the allocation of costs to the proper work functions was difficult and often erroneous.

There was also difficulty encountered when contract labor was utilized in the maintenance and repair area. The actual man-hours of contract labor were not reported--instead the cost of the contract was converted to "equivalent man-hours" for inclusion in the work measurement report. The computation required for the conversion from cost to "equivalent man-hours" was troublesome, and there was doubt that the "equivalent man hours" were valid expressions of work.

The Bureau of Yards and Docks, in response to the general discontent with the work measurement program, called a conference in which both Bureau and field representatives participated. The consensus of the conference was that though statistical work measurement was of some use, it was not

necessary for management purposes and therefore should be discontinued. Accordingly, the Bureau of Yards and Docks abandoned its functional work measurement program during 1958.[50]

One of the factors which enabled local management to recommend the discontinuance of the work measurement program was the existence of another mangement tool in the form of the Bureau of Yards and Docks Controlled Maintenance Program. Controlled Maintenance had been initiated in 1954. It employed industrial production control techniques to accomplish three principal objectives:

1. To bring Naval activities up to proper level of maintenance.
2. To increase the productivity of maintenance workers.
3. To save on services through methods engineering and better job planning.[51]

The controlled maintenance program served to standardize the organization of the Maintenance Control divisions in Public Works Departments and prescribed local control procedures covering work input, planning, job estimating, work scheduling, work accomplishment and performance evaluation. Essentially, it provided the local Public Works Officer a systematic method of controlling his operations. It gave him individual job control in place of the broader functional control provided

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[50]Interview with Mr. C. A. Besser, Manager, Management Statistics Branch, Bureau of Yards and Docks, March 15, 1961.

[51]"Controlled Maintenance," Navy Management Review, III, No. 5 (May 1958), p. 22.

by work measurement.

Individual job control was increased still further when the Bureau began developing and installing engineered performance standards for maintenance work. It is expected that 80 per cent of all maintenance and repair jobs will be covered by engineered standards by July 1961.

The Bureau has now succeeded in placing in the hands of local management the exacting tools of control of individual job performance which have so often been deplored as lacking in a functional work measurement system.

Some impressive accomplishments have been attributed to the application of these management tools.

> In the Fifth Naval District, Controlled Maintenance has resulted in the gradual reduction of maintenance personnel from approximately 11,400 in 1954 to approximately 9200 three years later.
> . . . . . .
> . . . the overall savings in total maintenance and operations allotments in the Fifth Naval District has been estimated to be equivalent to $8,000,000.00 annually.[52]

The Bureau has found that controlled maintenance and engineered standards are not an unalloyed blessing. Though they provide excellent means for local evaluation of individual jobs, they provide no means for broad overall measurement by which the Bureau can make inter-station comparisons of performance by functional area. To illustrate--local management can now determine how efficiently a man worked in repairing a radiator in a building, or in patching a hole in a runway; but the Bureau can no longer determine either how many man-hours

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[52] Ibid.

per 1000 square feet of floor space were expended to maintain barracks buildings or how many man hours were required to maintain 1000 square yards of runway for a month.

Individual jobs may be performed efficiently, but the question that cannot now be answered is, "Are all these jobs, which are being performed efficiently, necessary?" The answer is sometimes "no" as is shown in the following instance:

> . . . one shop which scored 100% on job standards was found to be spending quarterly 41 man hours per sedan. If we add on the normal associated cost of materials and overhead, this amounts to over $200.00 per sedan every three months and this excludes accident repairs, gas, oil and tires.[53]

The Bureau of Yards and Docks is now working on a project which should fill the information gap which was created when functional work measurement reporting was discontinued. The project involves the monthly collection of all maintenance and repair costs for each category of real property in the Navy Inventory of Real Property. The facilities of the Navy Accounting system are utilized in the collection of the costs.

Before the Bureau could proceed with this endeavor, it was necessary to revise the expenditure account (equivalent to cost accounts) structure of the Navy Accounting system. In July 1960 the Comptroller of the Navy revised the expenditure accounts so that the accounts in the series pertaining to real property would match the Department of Defense Category Codes for Military Real Property under which the Navy Inventory of

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[53]"Two Kinds of Work Measurement," op. cit., p. 3.

Real Property is maintained. The revision to the accounting system increased the number of expenditure accounts from 118 to 477. The impact of this change was felt throughout the Navy Shore Establishment. Most shore activities collect maintenance costs by means of a standing job order system keyed to expenditure accounts. Their job order accounting job tripled.

It is hoped that, after collecting all maintenance and repair costs for each category of real property for two years, a standard maintenance and repair cost can be developed for each category of property. The standard cost will become a measuring device to replace the functional work measurement standard. Lieutenant Commander Paul and Mr. Besser, who are working on the cost collection project expressed some uncertainty as to whether this approach to developing standard costs will be successful.[54]

The Bureau of Yards and Docks eliminated the complaints from field Public Works Offices concerning statistical work measurement, but now finds itself belabored by the accounting segment of the shore establishment. The job order accounting for the Controlled Maintenance Program, the Transportation Equipment Cost Control Reporting Program, and the collection of costs by real property category code have placed a staggering load on the Navy Accounting System. Mr. P. L. O'Connell, Director, Accounting Division, Office of the Assistant

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[54]Interview with Lieutenant Commander E. C. Paul, CEC, U. S. Navy, Assistant Director, Maintenance Division and Mr. C. A. Besser, Bureau of Yards and Docks, March 15, 1961.

Comptroller--Accounting and Finance stated, "We do more cost accounting now in the maintenance of facilities and automotive equipment than we do in the procurement and handling of missiles."[55]

The additional accounting has also received unfavorable comment from inspectors in the field. An article reporting on inspections in overseas facilities reported:

> Recommendations were made concerning the Controlled Maintenance Program and Transportation Equipment Cost Control Reporting Program. It was indicated that consideration should be given to eliminating those portions of the programs which are beyond the reasonable capabilities of the individual activities and are of doubtful value to their internal management.[56]

The experience of the Bureau of Yards and Docks, like that of the Bureau of Supplies and Accounts, show that the refinement of work measurement systems are costly and often introduce new problems. The point of diminishing return is difficult to distinguish, and it may be different among individual activities.

It is not possible to assess whether the abandonment of functional work measurement was an error. It is apparent that the Bureau of Yards and Docks lost an overall measurement device which will not be replaced for some time. It also

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[55]Lecture delivered by Mr. P. L. O'Connell, Director, Accounting Division, Office of the Assistant Comptroller of the Navy--Accounting and Finance to Navy Postgraduate Comptrollership Course, The George Washington University, April 14, 1961.

[56]"CINCNELM Reviews Administrative Practices," Navy Management Review, IV, No. 11 (November 1959).

appears that some field activities are having difficulty meeting the requirements of the new systems.

When Mr. Halstead, Director of Management Analysis and Review Division, Bureau of Yards and Docks was asked for his opinion on the cancellation of the statistical work measurement system he answered with a Delphic, "It's too bad our foresight is not as good as our hindsight."[57]

The Bureau of Ships and Functional Work Measurement

The Bureau of Ships manages a field organization composed of eleven naval shipyards, five assorted laboratories and test stations and six supervisors of shipbuilding. The shipyards, employing approximately 95,000, account for the bulk of the work force under the management of the Bureau. The majority of the work force perform industrial production type work, and the balance are engaged in support, service and administrative fields.

Currently, the Bureau of Ships administers no functional work measurement programs. However, the Supply Departments of the naval shipyards are participants in the Bureau of Supplies and Accounts work measurement program for Supply Distribution Activities. This program is accepted by the Bureau of Ships primarily because it provides a means for determining an

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[57] Interview with Mr. William Halstead, Director, Management Analysis and Review Division, Bureau of Yards and Docks, March 15, 1961.

equitable funding split in the budgeting of the Supply Departments. The work performed by the Supply Departments is divided into two segments: (1) industrial support of the shipyards which is funded by the Navy Industrial Fund; (2) military support which is funded by the Bureau of Supplies and Accounts. The functional areas of work measurement in the Bureau of Supplies and Accounts measurement system are identified with one or the other of the above mentioned types of support. As a result the work measurement data are used to distribute costs for supply operations to the appropriate debtor.

The Bureau of Ships has had experience with other functional work measurement programs. Three separate programs--Fiscal Services Work Measurement, Civilian Personal Services Work Measurement and Public Works Work Measurement--were put to use in 1950. Work was measured and reports were submitted in the three programs for five years. Then, in 1955, the Fiscal Services Program was cancelled by a notice which gave the following reason for its discontinuance:

> Major changes in the fiscal function by the inauguration of the Comptroller Department and the implementation of the Navy Industrial Fund with no corresponding changes in the reporting form has resulted in reports being prepared which are of little value to the activity or the Bureau of Ships.[58]

There is no record that any effort was made to revive the program.

Three more years passed before the Public Works Work Measurement Program was discontinued. The decision for this

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[58]U. S., Department of the Navy, Bureau of Ships BUSHIPS NOTICE 5202, September 1, 1955.

cancellation was explained as follows:

> A study of the Bureau's requirements in connection with shipyard public works functions reveals that a review of expenditures in this connection is available to the bureaus and higher level organizations from the Navy Industrial Fund Operating Statements and the periodic reports on costs of maintaining real property and operating utilities. Also, the implementation of the Transportation Equipment Maintenance Cost Control Program and the Controlled Maintenance Program has provided local management with comprehensive performance measurement reports. Therefore, it has been determined that the need for subject program as a performance control technique both at the Bureau and activity level has been greatly reduced and that the Navy Industrial Fund accounting structure provides sufficient functional breakdown for Bureau review purposes. Further the DOD Facility Class Codes for Real Property provide a data accumulation structure which can be used for budgetary and funds control purposes.[59]

The Civilian Personal Services Work Measurement Program was continued until 1959 when it also was considered to be unnecessary and, consequently, dropped.

It would seem that functional work measurement had been given a fair trial and found wanting by the Bureau of Ships.

On the other hand, there are a number of features peculiar to naval shipyards which might have a bearing on the acceptance and support that a functional work measurement program would receive. Among these features are the following:

(1) The major segment of labor in a shipyard is engaged in productive work; the management is production oriented. The Production Planning and Control Program which is vigorously pursued in the productive shops includes work measurement, engineered standards development and work methods improvement for local use. Management gives its full support and attention

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[59]U. S., Department of the Navy, Bureau of Ships, BUSHIPS INSTRUCTION 5202.13A, May 16, 1958.

to this program because substantial and tangible economies can be derived from it.

(2) The Bureau of Ships pursues what it calls a "freedom policy" in the administration of shipyards. The Shipyard Commander is subjected to as few Bureau centered controls as possible. He is expected to operate the shipyard in much the same manner as the superintendent of a commercial yard. He must use his managerial ability to produce the best product at the least cost. Bureau centered functional work measurement programs would impose outside controls which the Shipyard Commander might feel were not paying their way.

(3) The Navy Industrial Fund accounting produces innumerable statistical reports, some of which cover the same overhead and administrative areas as functional work measurement reports. They are nearly as informative, if not as informative, as work measurement reports. A work measurement program would produce duplicate information in a slightly different form.[60]

It would appear that the Bureau of Ships discontinuance of functional work measurement was not a rejection of this type program *per se*, but that it had other sources of the same information and therefore eliminated duplicate reporting.

The Office of the Chief of Naval Operations

The Office of the Chief of Naval Operations manages Naval Stations and Naval Communications Stations. Of the 18,775

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[60] Interview with Manual Wolfe, Management Control Division, Bureau of Ships, 2 April 1961.

military and civilian personnel manning these activities, 12,900 are employed by Naval Stations and 5,875 by Naval Communication Stations and Facilities. There is no work measurement program in effect by which the performance of these personnel may be evaluated.

One officer in the Field Activities Division of the Office of the Chief of Naval Operations is assigned the collateral duty as Work Measurement Officer. This assignment amounts to an acknowledgement of the Navy's work measurement program but little more. There are no plans or pressures for the development of a program for the Naval Stations. The feeling is that most of the work performed at the stations is not susceptible to work measurement. The Naval Stations are support activities providing a variety of services to the Fleet and Operating Forces. Their work load is sporadic--dependent upon the movement and employment of ships and forces. The station manning levels have to be such that service can be given when it is demanded. Their work is characterized by peaks of activity and valleys of inactivity. Work measurement is best suited to a steady flow work load. The Acting Financial and Management Assistant expressed the following opinion:

> There are only fourteen Naval Stations; we keep fairly good tabs on them through visits and inspections. We know pretty well which ones are 'fat' and which need help. A work measurement program would not provide much that we do not already know.[61]

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[61]Interview with Mr. W. J. Hagerty, Acting Financial and Management Assistant, Field Activities Division, Office of the Chief of Naval Operations, March 8, 1961.

In 1954 a work measurement program was inaugurated to measure the work at Naval Communications Stations and Facilities. This program was suspended after two and one half years of use to permit revision of the reporting system.[62] One revised report form was distributed to field activities in April 1957 for their evaluation and comment. That was the last action taken on the program. It is now dormant, and there does not seem to be any plan to revive it.

The Bureau of Medicine and Surgery

The Bureau of Medicine and Surgery relies on its financial management system for managerial and budgetary control of Naval Hospitals and Naval Medical Centers. A work measurement program, as such, does not exist. The financial management system, however, seems to provide an adequate substitute.

One of the elements of the financial management system is a quarterly financial plan. This plan requires that each field activity forecast planned work load, performance, and cost for each budget function cost center. Performance is measured by "performance indicators" which are equivalent to work units in a work measurement system. The Financial Management Handbook explains performance indicators in the following manner:

> A performance indicator has been identified with certain cost centers to the extent that the classification is sufficiently homogeneous or

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[62] U. S., Department of the Navy, Office of the Chief of Naval Operations, OPNAV NOTICE 5202, November 26, 1956.

> otherwise susceptible to gross or broad measurement for this Bureau's purposes. A performance indicator whether static or of a volume nature, is assigned for the purpose of expressing the relationship of the projected work level, work level in being, or to the work accomplished in relation to the level of resources utilization.[63]

As the field activity executes its budget, the financial plan updated so that planned and actual workload, costs, and cost per performance indicator can be compared. In essence the financial plan is a work measurement program which has been completely integrated with financial management reporting. It gives management a report of budget execution by cost center and it also indicates the efficiency of performance by reflecting the cost per work unit.

The system has been in use only since June 1960. Standard costs per performance indicator have not been developed, and there is uncertainty as to whether they will prove to be feasible. However, both the Bureau and the reporting activities have an excellent, compact tool for measurement of performance in the financial plan.

Summary

Work measurement means something different to each Bureau and Office. Some--the Bureau of Supplies and Accounts, Office of the Comptroller, Office of Naval Material--have found it a useful management and budgetary tool, while others--

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[63] U. S., Department of the Navy, Bureau of Medicine and Surgery, Financial Management Handbook, NAVMED P-5020, June, 1959.

the Bureau of Yards and Docks, the Bureau of Ships, the Office of the Chief of Naval Operations--have found it useless, or more trouble than it was worth.

Some have developed comparatively simple, inexpensive measurement systems, while others have extremely detailed and costly ones. The design of the system does not necessarily give an indication of its effectiveness. The simple programs used by the Comptroller seem as effective as the elaborate programs of the Bureau of Supplies and Accounts. On the other hand, the comparatively uncomplicated system administered by the Bureau of Naval Personnel is of little consequence in budgeting.

It has been possible to set firm standards of performance in the FAME program and that of the Navy Accounts Disbursing Offices, but the Bureau of Supplies and Accounts and the Navy Regional Accounts Offices have determined that their respective field activities are not comparable and cannot be measured by a common yardstick. This finding is particularly significant since these field activities are organizationally similar and they perform like work.

The absence of meaningful standards in the Bureau of Supplies and Accounts system is considered a prime weakness because neither local nor Bureau managers can make an objective evaluation of performance; yet the Bureau of Yards and Docks program was discarded largely because of the constant criticism of the standards.

The mere presence of standards is no indication of the

effectiveness of a program--the Bureau of Personnel has set standards, but its programs are of little use; the Navy Regional Accounts Offices have no standards but the program is effective.

There has been a tendency to move away from the statistical measurement programs and toward engineered standards. The Bureau of Yards and Docks, the Bureau of Ships, and now, the Bureau of Supplies and Accounts have made the move. The engineered standards give local management better control of individual performance but they are expensive and slow to develop. If engineered standards displace functional work measurement entirely, the Bureaus and Offices are at a loss in trying to make inter-station comparisons of performance unless some other reporting system is developed to take the place of functional work measurement reports. The Navy Industrial Fund Accounting reports perform this function for the Bureau of Ships; the Bureau of Yards and Docks was forced to develop a cost collection system to fill the gap.

The Bureau of Medicine and Surgery though it has no separate work measurement reporting system is able to evaluate both work and budgetary performance by incorporating the information in its financial plans.

CHAPTER VII

CONCLUSIONS

There are many factors which have an influence on the usefulness and acceptability of a statistical work measurement program. The most important of these factors from the writer's viewpoint are:

(1) The attitude of Management toward statistical work measurement;

(2) The type field organization that is to be measured;

(3) The kind of work which is to be measured;

(4) The intended use of the work measurement data.

These factors can be considered separately but such consideration gives only a partial picture. There is interplay between them which must also be taken into account.

There can be little argument that the strong support of Management at all levels is required if a program is to have a chance of being successful. This support must be more than verbal or moral--it has to be expressed in terms of money and manpower support. The development of an adequate program requires extensive analysis of the work and the activities to be measured, followed by careful design of a measurement system. When management is faced with the commitment of substantial funds for such development, the attitude or willingness to

support a program may change. It may accept an inferior program which will involve only low development costs. Ultimately an inferior program will usually produce inferior results and management's moral support will disappear.

It is difficult to get the strong financial support required for a meaningful program. When large costs are involved, management must have concrete justification for their incurrence, and this is usually lacking when a work measurement program is in the idea stage. Expected returns from a work measurement program are nebulous before the program is activated.

Mr. Wolfe of the Management Control Division of the Bureau of Ships drew from a parallel situation to illustrate the difficulty in justifying a management improvement program in terms of dollars. He related:

> A new work measurement program is hard to justify. You run into much the same difficulty that I had in trying to get a quality control program started in the shipyards.
>
> In reviewing the reports from the shipyards, I noticed that there were only piddling amounts being reported for waste and spoiled or broken work. Now, there are expenditure accounts against which spoiled and broken work are supposed to be reported, but no one wants to report mistakes so they hide them by charging them to productive jobs.
>
> My father operated his own shop and when waste, breakage, and spoiled work was less than 2 per cent he knew something was wrong. Either someone was hiding waste by charging another job or they were working too carefully. I felt that this was the situation in the shipyards. The reports gave us no quality control. They might be hiding excessive waste and spoilage but no one could detect it or do anything to control it.
>
> I worked up a proposal for a quality control program and the proposal was approved right up to the top of the line. Then when I got down to specifics and took them to my boss, he asked what I figured it would take to operate the program. I estimated about five men

> per shipyard, about $40,000.00 per year; there were twelve shipyards so there was a half a million. Then he asked what waste was running now. We would be lucky to show a total of $45,000.00 a year from the reports.
>
> So there you are--how can you justify a half million? We know there is a potential for savings but try to show it in black and white.
>
> You run into the same thing in Work Measurement--you can't justify the expenditure to start the program right.[1]

The type of field organization which is being managed will have an influence on the amount of management support a program receives. Here, once more, costs become a governing factor. If a single program can be developed to measure all field activities the climate will be much more favorable than it would be if a number of programs have to be developed. The analysis, development and maintenance of multiple good programs might involve costs in excess of expected returns. The Bureau of Naval Personnel field organization is an example. This widespread group of relatively small activities performing different functions would require significant expenditures of money and manpower if meaningful measurement systems were to be developed for all of them. The cost of maintenance of the system would also be high. Justification for such expenditures would be difficult to develop. As a result, inferior measurement systems which produce comparatively meaningless information are used and are disregarded by management.

The kind of work to be measured will have a significant influence on the kind of results produced by the system.

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[1] Interview with Mr. Manual Wolfe, Management Control Division, Bureau of Ships, 2 April 1961.

Statistical measurement is best adapted to a steady flow process where a uniform, identifiable product can be measured. There have been attempts made in the Navy to measure all kinds of work with statistical systems and in most cases the results have been close to meaningless. Even shipyards at one time tried to use statistical measurement for evaluating productive shop output. Management engineers made the following comment on this effort:

> Shipyard work, especially in government, poses management control problems seldom encountered on a large scale in industry. With the possible exception of trades such as forge, welding, electrical, printing and standardized manufacturing of flags, sails, rope, chains, etc., substantially less than half the jobs processed by individual shops are repetitive. As a consequence, it is impossible to measure accurately by count of physical work units, more than a fraction of productive effort of shops.[2]

When work measurement is applied to work which is not of a type that is susceptible of measurement, and decisions are made on the basis of meaningless results, it is inevitable that management support will be lost and the phrase "work measurement" will fall into disrepute.

It is believed that some of the Bureaus which have used statistical work measurement have attempted to utilize it for purposes to which it is not adapted. It should be recognized for what it is--a "fire alarm" and a trend indicator. It appears that it has valid use as a broad indicator, but in most cases no more should be demanded or expected of it. If management wants individual job control, it should not try

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[2] Cresap, McCormick, Paget, op. cit., p. I-8.

to get it by refining statistical measurement on a Navy-wide basis. The experience of the Bureau of Supplies and Accounts should act as substantiation of this statement. Its programs have been refined to the point that they have become expensive and unwieldy for local management; they produce a wealth of information but they still leave much to be desired in the way of either local or Bureau control.

The idea that a program can be designed to measure and compare "Common Services" at all field activities appears to be fallacious. The Bureau of Supplies and Accounts and the Navy Regional Accounts Offices have found that even in like organizations performing like work there exist factors which introduce uncontrollable variables into production rates so that activities are not comparable. If this is the case, how could it be expected that unlike activities performing a variety of missions could be measured by a common yardstick? The Bureau of Yards and Docks established Navy-wide standards for its Common Service Public Works program, but the standards were the basis for constant criticism from the field.

If a standard is to be useful to local management, it must be attainable; if it is to be used for budgeting it must have validity. A standard which is developed by averaging Navy-wide performance experience may be neither attainable nor valid at any particular field activity. Therefore the use of statistical standards for the purpose of arriving at firm decisions on the performance and budgets of diverse activities will nearly certainly result in inequitable treatment which in turn will cause acute dissatisfaction on the part of the injured.

It appears to this writer on the basis of his observations that statistical work measurement and statistical performance standards are most effective when applied to standard organizations performing a narrow range of functions in a standardized manner. The Navy Accounts Disbursing Offices are the best example of this type operation. The General Inspection Offices managed by the Office of Naval Material also closely match this description. The FAME program illustrates that careful development of a program to measure this kind of activity may result in spectacular dividends.

APPENDIX A

The writer forwarded a questionnaire to the twenty-one major activities which participated in the Bureau of Supplies and Accounts Work Measurement Program for Supply Distribution activities. Twenty of the questionnaires were completed and returned.

The questionnaire was primarily an opinion poll on various aspects of the Work Measurement Program.

The questions and the answers received are tabulated below.

1. How would you classify the utility of data collected in the work measurement program as a management control tool?
   (a) very effective 5
   (b) effective 14
   (c) of limited value 3
   (d) useless 0

   Note: One respondent rated the program "very effective for top management's use"; effective for division head use; and of limited value below the division level.

2. How would you classify the data collected as a tool for use in budget formulation and justification?
   (a) very effective 5
   (b) effective 14
   (c) of limited value 1
   (d) useless

3. Is the data which is collected for work measurement reporting reduced to chart form for presentation to top management?
   (a) yes 17
   (b) no 2

   Individual comments concerning the above question:
   Because of the bulk of the new work measurement form, shipyards have discontinued supplying each other with copies of it. Thus, comparative charting among the shipyards has been discontinued. Local charting is maintained by concerned supervisors of their functions.

4. If the above answer is "yes", how frequently are the charts updated?

(a)	weekly	3
(b)	bi-weekly	
(c)	monthly	18
(d)	quarterly	6
(e)	other (specify)	see below

Individual comments concerning the above question.

(e) (1.) For use in seminars and conferences to illustrate achievements, effectiveness, economy of operation, or other matters under discussion.

(e) (2) As special situation requires.

5. Can the activity specifically identify savings or reductions in cost which have resulted from application of information derived from work measurement reports?

(a)	yes	14
(b)	no	6
(c)	give example	

Individual comments concerning above question.

(c) (1) Information contained in the Work Measurement Reports was prime source for forecasting the Bay Area Support Plan workload, etc., and phasing the personnel reductions.

(c) (2) When analyzing the production and workload trends of a Supply function for the BuSandA six months' budget (NavSandA Form 678), the past history may reflect variations in authorized planned staffing versus the actual staffing and may indicate evidence of over-staffing, which means that the planned production rate and workload trend could be accomplished and maintained with less personnel. In this case, the Budget Analyst could reduce the staffing in the function for the ensuing six months period. This in turn would produce a savings to the activity.

(c) (3) Ordnance Supply Depot and others have loaned people and offered up complement based on work measurement data.

(c) (4) Yes to a limited degree. Recently, the Supply Mission of this command was changed to eliminate support of the supply system and to provide for supply support to shipyard only. Work measurement figures were utilized in planning for a reduction of 135 in personnel.

(c) (5) Analysis of production rates and workloads pointed up excess staffing in packing functions. This later confirmed by method engineering study, based on engineered time standards, resulted in reduction of 16 people.

(c) (6) Comparison of local production rate for Parcel Post with Navy-wide average showed local rate considerably lower. Implementation of improved methods of operations as a result of studies increased local rate from 3.74 to 7.22.

(c) (7) Manpower excesses are pinpointed.

(c) (8) Reduction in personnel in accordance with workload level.

(c) (9) No, savings are effected by day-to-day observation of operations and size of workload processed, with some guidance from work measurement.

(c)(10) Increase, decrease personnel

(c)(11) Production figures allow for corrective actions and monetary savings. Work measurement data reflects areas where savings are possible. Thus less manpower and costs required. This is reflected in allotment requests and justification.

(c)(12) Naval Supply Depot has reduced costs in several major functions through the application of information derived from its work measurement reports and summaries. Specifically, Traffic, Marine Terminal, and Storage functions have benefitted. Application of improved production rates has enabled this activity to: (1) make personnel shifts between specific functions of these major groups, thus reducing overtime usage; and (2) obtain a reduction in manpower.

6. Do you feel that the work measurement program provides an effective incentive for the working group to improve its productivity?

(a) Yes 12
(b) No 7

Individual comments concerning the above question:

(a) (1) To a limited degree. It is of some importance to the concerned supervisor .

(a) (2) Yes, but limited in value because of use of historical goals which do not reflect what <u>should</u> be done. Complement based on work measurement data.

(a) (3) To a limited degree.

7. Has the dollar cost of the recording, compiling, and reporting of work measurement data been determined for the activity?
   (a) Yes 6
   (b) No 14
   1. The range of monthly costs reported in were from 1165.00 to 2500.00.

   Individual comments concerning above question:
   (a) (1) $2,000 Includes personnel and reproduction costs.

   (a) (2) The monthly cost of compiling, recording and reporting of work measurement data was calculated for Fiscal Year 1959 at $1,165.00. We would estimate $1,284.00 for Fiscal Year 1961, taking into consideration the extra Electrical Accounting Machine time expended.

8. Estimate the percentage of total "production time" reported by the activity which is spent in the collection, recording, and analysis of work measurement data.

   (1) The percentages reported ranged from 0.4 to 5.

9. One writer on BUSANDA work measurement said that he found that his employees often concentrated on accomplishing measured work at the expense of unmeasured work. He made particular reference to a non-mechanized stock control branch where little credit could be claimed for time spent in reviewing stock records for accuracy, stock status and quality of work--only changes actually made could be counted. Has this experience, concentration on measurement work at the expense of unmeasured, been noted at your activity?
   (a) Yes 5
   (b) No 14

   Individual comments concerning above question:
   (a) (1) Because, in most instances, the measured work unit is the most important part of the work performed within the function, it is only normal this should be accomplished first. In the case cited, most certainly one is not going to permit issue documents to pile up while performing file maintenance tasks.

   (a) (2) Yes, there is a tendency but not a serious problem. Of greater importance is the tendency for supervisors to move people to either unmeasured functions or functions with nebulous productive rates such as storage custody.

   (a) (3) Only instances to date are in areas where an abnormal increase in workload required all effort to concentrate on processing measured work (in Issue Control and Household Goods) and

filing, correspondence, etc. was allowed to accumulate temporarily.

10. Has appreciable difficulty been experienced in ensuring accurate counts of work units completed?
    (a) Yes 11
    (b) No 9

11. If the answer to the previous question is "yes" what factor seems to be the most contributory to the inaccuracies?
    (1) estimating measurement tons
    (2) Occurs mainly in areas where there are no means of setting up a system of "checks and balances" and where difficult to police.
    (3) Usually because of turnover of personnel where new employees did not completely understand the procedures involved.
    (4) Methods of calculating measurement tons of small items.
    (5) Difficulty in policing.
    (6) Carelessness in counting and reporting work units.
    (7) Undocumented work units; i.e., measurement tons.
    (8) Especially in the "M/T" functions and purchase document preparation. (Both have been resolved).
    (9) The various interpretations placed on the Work Measurement Manual.
    (10) Lack of personnel to police system.
    (11) Failure to read and understand instructions.

12. Can "doctoring" of reported completed work units be readily recognized by reviewing officers or supervisors?
    (a) Yes 17
    (b) No 3

    Individual comments concerning the above question:
    (a) (1) Yes, in most instances
    (a) (2) Not in every case
    (3) To some extent. This requires very detailed analysis of data pertaining to related functions. These latter in turn may be tempered by types of measured work which could affect the production rates of the function under analysis.
    (4) "Doctoring" of reported completed work units can be immediately recognized with possibly the exception of the undocumented type work unit counts such as measurement tons which are normally not subject to verification.
    (5) Doctoring can be detected in some areas more readily than others.
    (6) In some cases yes, in others no. Unquestionably, there is "doctoring"--particularly in the areas of hand counting.

13. Has the new reporting form which was introduced in 1960, NavSandA Form 1143(5C)(6-60) increased the time required to prepare the reports to the Bureau?
   (a) Yes, materially 16
   (b) Yes, but not significantly 3
   (c) No 1

Individual comments concerning the above question
   (a) (1) The less complicated reporting of the 1950-52 period gave us good information with much less effort.

14. Is the above new report form more useful at the activity level in appraising results and in forecasting?
   (a) Yes 7
   (b) No 13

Individual comments concerning the above question.
   (b) (1) Its value has been materially decreased.

15. Many of the functions identified in Chapter 5 of the BuSandA Management Handbook are not measured by specific work units; this is particularly true in the public works area. Is it possible to use the cost data which is reported under these functions for effective control and evaluation purposes?
   (a) Yes
   (b) No

Individual comments concerning the above question.
   (a) (1) To a limited degree. At a shipyard many of the P.W. type functions are not controllable by supply.

   (a) (2) Under the current reporting system, Naval Supply Depot, has found means of comparing man-hours expended against the planned man-hour projections--particularly in Public Works area. This is done by combining the Work Measurement Program with the Maintenance Control Program thereby producing an effective evaluation of these functions.

   (b) (1) Not applicable to shipyards.

   (b) (2) No, simply provides historical picture, does not give indication of what "should have been spent."

   (b) (3) The cost data reported in the Work Measurement reports are the result of effective control implemented through BuDocks Maintenance Control Program directives. The resultant costs, as a whole, are used for budgetary purposes, and for comparing total costs for one period to another, or comparable periods of fiscal years.

16. The Bureau of Supplies and Accounts has not established Navy-wide performance "norms", but expects each reporting activity to compare its performance against its own past performance and its own forecasts of future performances. Some other bureaus and offices have established "norms" by statistical methods which each reporting activity is expected to match in the performance of its functions. Would the establishment of statistical "norms" for BuSandA functions make work measurement more effective or useful at the activity level?

(a) Yes 7
(b) No 13

Individual comments concerning the above question.

(b) (1) No. A few years ago, "norms" were established for Supply Departments by the Bureau of Supplies and Accounts. Due to variances in mission of the S.D. at shipyards, the establishment of "norms" would not serve any useful purposes, inasmuch as significant differences occur in "processing times" for apparently similar functions, e.g., an activity which performs purchasing functions equivalent to a Navy Purchasing Office cannot be "matched" with an activity having limited purchasing authority.

(b) (2) There are too many variables between missions, etc., of Shipyards.

(b) (3) No, because of varying missions among shipyards.

(a) (1) Yes, if the norms were "valid". However, valid "norms" are difficult because of lack of complete standardization.

(a) (2) Yes, only if more sophisticated statistical methods are used to compute standards which will account for differences in productivity as it relates to volume of work.

17. One recent writer on the subject of work measurement in BuSandA activities advocates the integration of the current functional work measurement system with Engineered Performance Standards. Basically, he advocates that standard times for performing individual jobs be determined by time and motion studies. Then using these standard times as building blocks "norms" for measurable functions would be developed. All reporting activities would then be compared performance-wise against these "norms". Do you consider that this refinement of the present measurement and reporting system would give management a more meaningful tool for evaluating performance?

(a) Yes 13
(b) No 7

Individual comments concerning the above question.

(a) (1) Only in activities that can economically profit from such programs.

(a) (2) Yes, but cost would be very high.

(a) (3) "Norms" would be different for each activity because of variations of conditions. Travel distances, plant layouts, frequencies, methods, etc. will be different at each activity.

(a) (4) But, the cost is prohibitive.

(a) (5) But not for comparing one activity with another.

(b) (1) Again due to the wide variances in the degree of missions at the various Supply Depts. of shipyards, "measurable functions" vary in depth and range of work required to be accomplished, thereby diffusing the intents of the application of "norms". Establishment of "Engineered Performance Standards" could, however, be effected for the individual shipyards by the accomplishment of related "Time-motion" studies.

(b) (2) Unless comparison made against local norms only.

(b) (3) Too many intangibles.

(b) (4) No, because of varying missions among shipyards.

(b) (5) No, because of different techniques and "unmeasured" production differences. The EPS developed goals would be valid at a particular activity and a comparison of such computed goals would indicate areas where an exchange of information between activities would be advisable. For example, if a Depot developed a goal of 10.0 for Issue Control and another developed only 5.0; it would be advisable for the activity with 5.0 to explore how the other activity can get greater productivity performing the same basic job. If the "norms" were used by an activity only, then the answer would be "yes". It is the comparison of apples and oranges which causes the difficulty.

18. It has been stated that the efficiency of clerical workers could be increased by from 20% to 60% if they were subject to individual engineered performance standards. Would you favor the establishment of individual engineered performance standards in preference to the current functional group measurement?

(a) Yes 11
(b) No 8

Individual comments concerning above question.

(a) (1) Methods Engineering Studies commenced 13 March 1961. Will result in setting Engineered Time Standards.

(a) (2) Yes, provided they were synthesized into group standards that would tie into work measurement functions. Establishment of individual standards for the 4,800 people at N.S. Center would represent a fantastic installation and upkeep task. In addition, such minute data is not needed for management control.

(a) (3) To the extent the engineered time standards are developed locally and are not used for comparisons among shipyards.

(a) (4) Only in activities that can economically profit from such programs.

(a) (5) Yes, if funds and ceilings would allow.

(a) (6) 20% to 60% is considered too high an estimate for NSC Norfolk. Engineered standards developed here are very close to statistical standards.

(a) (7) By rising individual engineered standards to arrive at a group standard.

(b) (1) Morale factor involved; too much reporting required.

(b) (2) No, because we don't have the talent to do it properly.

19. How would you classify the instructions covering the compilation and preparation of work measurement reports from the standpoint of:

(a) Detail
(1) excessive 3
(2) adequate 17
(3) inadequate

(b) Complexity
(1) difficult to understand
(2) require study 18
(3) easily interpreted 3

(c) Dissemination
(1) all interested parties cannot be adequately informed 1
(2) require lengthy indoctrination period before they can be used effectively 13
(3) are easily passed to and understood by all interested parties 5

Individual comments concerning above question.

(a) (1) The present work measurement program is a very useful management tool. Analysis and presentations of work loads, backlogs, and productivity provide management with an accurate picture of all operations. It allows for alignment of manpower with existing work loads. Budgetary forecasting and formulation is an important part of this program.

(b) (1) For application to individual activities.

(c) (1) With minimum interpretation for local use.

(c) (2) Some indoctrination required but, while information is not "easily passed to and understood by all interested parties," "lengthy indoctrination" is not required.

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